Second Annual Hardware Buyer's Superguide!

The Magazine for Business Computing Experts

June 1993

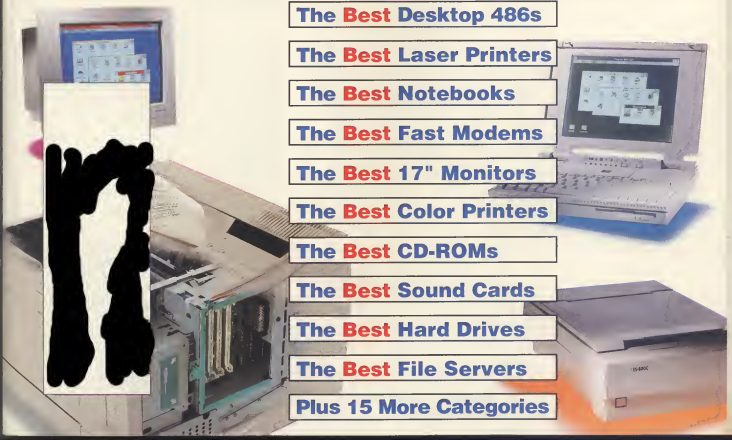
PC Computing

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Biggest ZD Labs Test Ever!

the Best 200

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- The Best Desktop 486s
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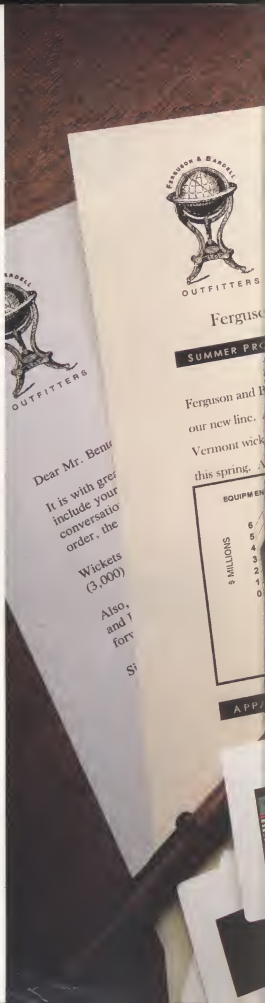


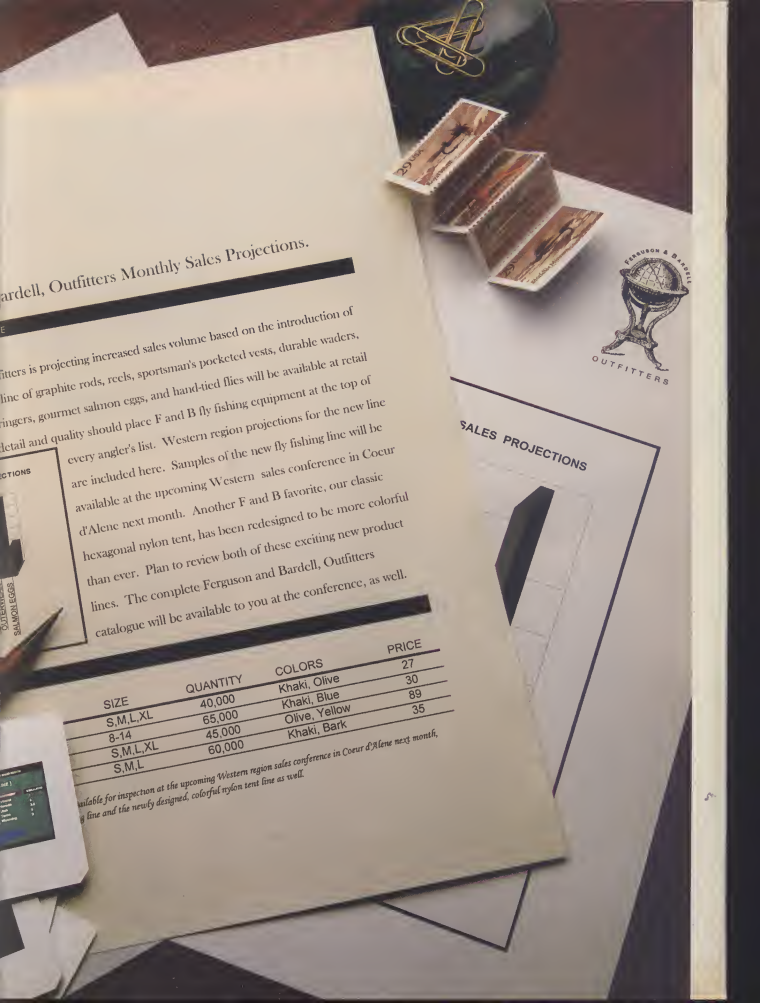
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ardell, Outfitters Monthly Sales Projections.

E

fitters is projecting increased sales volume based on the introduction of line of graphite rods, reels, sportsman's pocketed vests, durable waders, ringers, gourmet salmon eggs, and hand-tied flies will be available at retail detail and quality should place F and B fly fishing equipment at the top of every angler's list. Western region projections for the new line are included here. Samples of the new fly fishing line will be available at the upcoming Western sales conference in Coeur d'Alene next month. Another F and B favorite, our classic hexagonal nylon tent, has been redesigned to be more colorful than ever. Plan to review both of these exciting new product lines. The complete Ferguson and Bardell, Outfitters catalogue will be available to you at the conference, as well.

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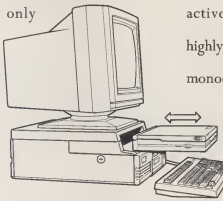
THE COMPAQ LTE LITE. FOR THEIR TIME WORKING. AND

OK, we're not saying you live on three hours of sleep, or that you eat Chinese takeout every night. And even if you do, we're not saying that a COMPAQ LTE Lite 486SL notebook is suddenly going to change all that.



What we will say is that it could make your life a lot simpler. Particularly if you travel.

You see, on one hand, these new computers are lightweight, compact notebooks (6.3 pounds, 8.5"x11"). They're available with three different screens: the COMPAQ UltraView – the world's only black and white, active matrix VGA; a 256-color active matrix; and the highly acclaimed passive monochrome MaxLight. There's the integrated EasyPoint trackball. And each has a range of innovative power-conservation features to help extend battery life.



Simply slide the LTE Lite notebook into the COMPAQ Desktop Expansion Base and you have a full-function, fully connected desktop computer.

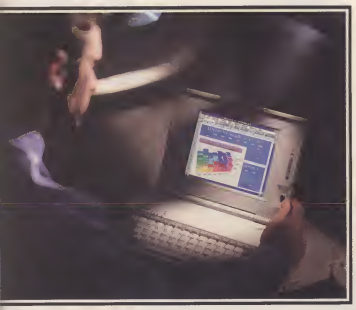
But what also makes these notebooks unique is

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PEOPLE WHO SPEND HALF THE OTHER HALF WORKING.

that they double as full-sized, full-featured 486 desktop PCs.

By simply sliding your LTE Lite notebook into the COMPAQ Desktop Expansion Base, you're instantly connected to printers, peripherals and your network. No floppies, no fumbling with wires, no headaches. And the extra slots and drive bays increase expansion capabilities. Best of all, you're using the same hard drive. So whether you're in the office or on the road, your files are always with you. The expansion base also offers you a keylock to secure your notebook.



Of course, if you don't need all the functions of a full-sized PC, but want easy connection to your peripherals, choose the new Enhanced QuickConnect – a one-step system with integrated Ethernet and SCSI support.

And like all of our PCs, these notebooks are backed by CompaqCare. Which includes a free, three-year worldwide warranty, and a year of free on-site* service in the U.S. or Canada.

For more information about the COMPAQ LTE Lite 486SL notebooks, call 1-800-345-1518. Because if you work out of the office on a regular basis, you really lead two lives. So they're perfect for you. And you.



Unlike other 486 chips, the Intel 486SL, with an integrated numeric coprocessor, provides higher performance and extended battery life.



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COMPAQ

*This service is provided by Contracted Service Providers and may not be available in certain geographic locations. Certain restrictions and exclusions apply. Monitors, battery packs and certain options are covered by a one-year warranty. For further details on our limited warranty, contact the Compaq Customer Support Center.

Circle 251 on reader service card.

COMPAQ CONTURA. THE AFFOR LEAVE YOU WISHING YOU

Buying some low-priced 486 notebooks is like buying a bottom of the line car. You drive off without power steering or air conditioning or even floormats. If you get away with an AM radio, you've pulled off a coup.

At Compaq, however, we believe an affordable notebook shouldn't merely be the stripped-down, bare-bones version of a more expensive one.

Take the new 486SL Contura notebooks.

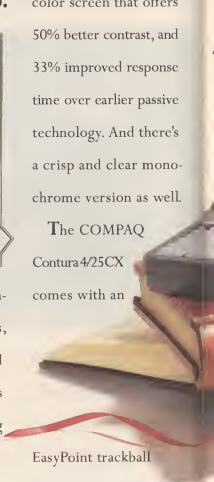
Although affordably priced, they're COMPAQ computers in the truest sense. They endure the same torturous testing as every other computer that we build.

Inside there's an Intel 486SL chip. Unlike the 486SX chip in comparably priced notebooks, this one has an integrated coprocessor. And it runs more efficiently, helping to extend battery life.

You have your choice of three Contura screens, all of which offer razor-sharp definition. There's an active matrix screen that displays information in 256 colors. There's an advanced passive matrix color screen that offers 50% better contrast, and 33% improved response time over earlier passive technology. And there's a crisp and clear monochrome version as well.

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4/25CX: *Active color VGA + Integrated EasyPoint trackball + NiMH battery* + **4/25C:** *Advanced passive color VGA + COMPAQ Trackball + NiMH battery* + **4/25:** *Monochrome VGA + COMPAQ Trackball + Enhanced NiCd battery*
All models: *Intel 25MHz 486SL with 8K cache and numeric coprocessor + 4MB RAM (up to 20MB) + 120MB or 209MB hard drive + Pre-installed Microsoft Windows 3.1 and MS-DOS 5.0 as published by Compaq*
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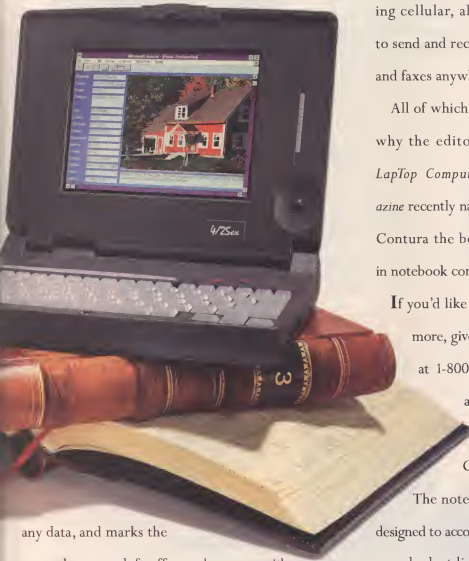


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DABLE NOTEBOOK THAT WON'T COULD AFFORD MORE.

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Contura notebook PCs also come with an external battery charger that lets you recharge batteries in as little as an hour. And a variety of modem options, including cellular, allow you to send and receive data and faxes anywhere.



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*Nothing is backed like a Compaq because nothing is built like a Compaq. Contura includes a free three-year, worldwide warranty with a year of on-site** service in the US or Canada.*

COMPAQ

*In tests run by Compaq using *PC Magazine* Labs WinBench Release 3.1. **This service is provided by Contracted Service Providers and may not be available in certain geographic locations. Certain restrictions and exclusions apply. Monitors, battery packs and certain options are covered by a one-year warranty. For further details on our limited warranty, contact the Compaq Customer Support Center

Circle 252 on reader service card.

PC Computing

124 Hardware Buyer's Superguide

PC/Computing STAFF

Get ready to make your next hardware purchase! The Hardware Buyer's Superguide presents the 200 best hardware products you can buy. And it arms you to the teeth with choices for specific needs and insider knowledge on product categories. Here's everything you need to make the right purchase decision.





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COVER PHOTOGRAPHS BY ERNIE FRIEDLANDER AND FRED STIMSON

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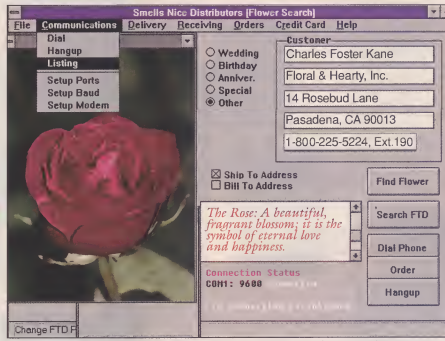


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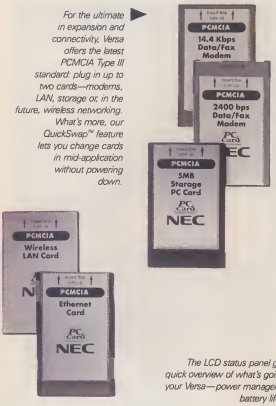
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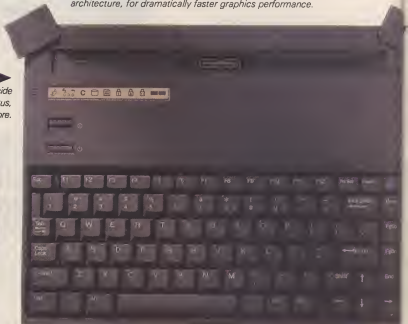


For the ultimate in expansion and connectivity, Versa offers the latest PCMCIA Type III standard: plug in up to two cards—modems, LAN, storage or, in the future, wireless networking. What's more, our QuickSwap™ feature lets you change cards in mid-application without powering down.



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Versa comes standard with a Nickel Metal Hydride (NiMH) battery, for longer life and quick recharging.

intel inside

3-year limited warranty is standard. UltraCare enhanced warranty program is available in first year upon completion of UltraLink Versa registration card. For more details, call 1-800-NEC-INFO. †Nanosecond (ns) is the initial †Non-blocking/pipeline available 2nd quarter 1995. Pixel expansion to 12MB today, 20MB and 3rd slot 1Q, 32MB and 3rd slot 2nd qtr. 16. UltraLink is a registered trademark of NEC Corporation. Ultra, Ni Versa, FastPack, QuickSwap and DoubleTime are trademarks and UltraLink a service mark of NEC Technologies, Inc. Docking Station is a trademark of NEC Home Electronics, Inc. The Intel Inside logo is a registered trademark of Intel Corp. All other trademarks or registered trademarks are the property of their respective holders. © 1994 NEC Technologies, Inc.

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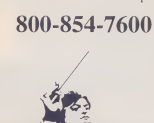
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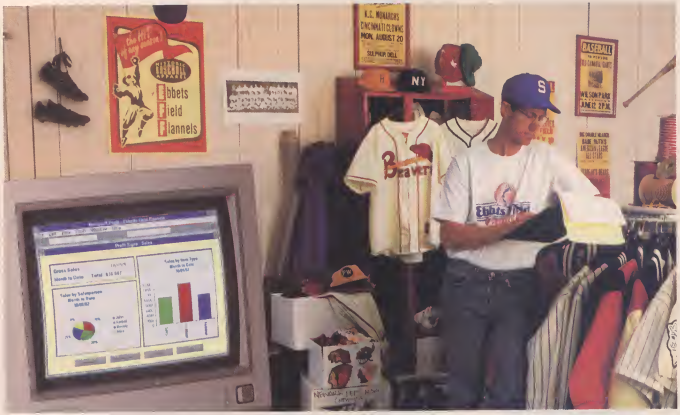
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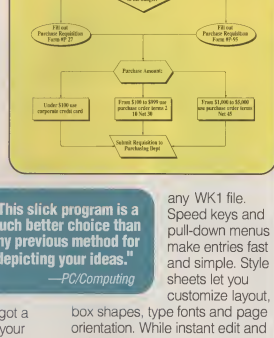
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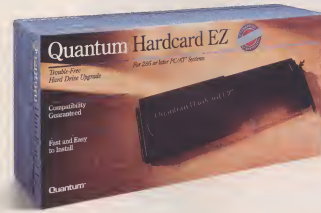
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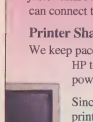


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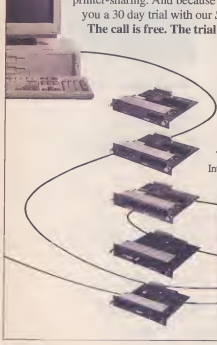
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In the Silence of the Testing Lab, You Can't Hear the Real-World Story

I WISH WE DIDN'T HAVE TO SPEND SO MUCH TIME IN TEST LABS.

Even the world's best lab bears only a passing resemblance to the real world. Lab technicians, unlike the rest of us, actually *read* instruction manuals. In a lab, unlike in the real world, your power cord always reaches a nearby outlet. And when you pick up a lab phone to call tech support, someone always answers! Don't tell me *that* happens on the outside.



Test labs are a necessary evil. The only sure-fire way to measure the fundamental differences between PC products is to set them up side by side and compare them, under tightly controlled conditions, in a laboratory environment. For this year's edition of the *PC/Computing* 200, we did just that, essentially moving half of our editorial staff into the world's largest independent computer-product testing facility, ZD Labs, for four months. After running more than 30,000 individual tests, we learned everything that mattered about the 525 products that passed through the labs and the 200 that made our final list.

But there's a whole class of knowledge you can't pick up from any lab except the one we call the real world. The experiments aren't reproducible, the testers don't wear white lab coats, and there are never enough power outlets. Still, the results have the unmistakable ring of truth.

In the real world, an upgrade is only worth it if you can *feel* the difference. Don't settle for puny increases in power and performance. One California-based department manager told me about the time he switched an entire office full of PCs from 286s to 16MHz 386SXs, literally overnight. The speed boost was about 35 percent, and he was devastated when the rest of the office *simply didn't notice*. "In fact," he said sadly, "they kept calling the new machines 286s, no matter how many times I told them there was a powerful new processor inside that could do much more than their old machines."

He learned his lesson. Last year, when it was time for another round of hardware buying, he switched the entire installed base to 486/33s—a fasten-your-seatbelts turbocharge of about 400 percent. "This time," he said, "I watched people's faces light up when they discovered how fast their old applications could really run. Now, when I'm planning a mass upgrade, I tell vendors, 'We're not buying until we have your guarantee that users will say *Wow!*'"

In the real world, little things matter. Like water dripping from a leaky faucet, tiny irritations will ultimately drive you straight over the edge. Case in point: PC cases that lock in place with eight or nine industrial-grade bolts. It doesn't seem like a big deal until it's time to upgrade network cards, or install additional memory, or add CD-ROM drives to 20 machines. At an extra 10 minutes per case, that's nearly half a day wasted each time you service an office worth of computers. Why not hold out for a case that snaps open and shut quickly without tools?

And speaking of time wasters, do you know where all your hardware manuals are? I don't. That's why in the real world you give extra points to designers who clearly label the little jumpers on add-in cards instead of simply stenciling J1 somewhere in the vicinity—and why you buy stock in companies whose add-in boards don't *need* jumpers.

In the real world, everything takes twice as long and costs five times as much as you thought it would. Recently, a team of *PC/Computing* editors and ZD Labs technicians consulted with a neighbor of ours, the City of San Carlos, on a large-scale network upgrade. "Budget about $100 per connection for wiring," our experts recommended. Good advice, at least for a sparkling new facility like ZD Labs. In the real world, though—in this case, the 24-year-old San Carlos City Hall—concrete floors and mahogany walls get in the way when it's time to string cable. The actual cost of the wiring? Nearly $500 a seat.

In the real world, people use applications that work for them, not the ones they're given. Software vendors dream of huge offices where their products can become corporate standards used by every worker in the place. But that's not the way the real world works. Try this experiment: Walk into an office full of sophisticated Windows users and install WordPerfect for Windows on every machine. Within a week, copies of Microsoft Word and Ami Pro will begin appearing, as if by magic, on two out of three hard drives in the place. It's human nature.

One reader told me he ordered Aldus's IntelliDraw for every worker in his department. He trained, he evangelized, and eventually he even begged. Nothing could convince his co-workers to use the new tool. The boxes of software sat around gathering dust. A few months later, he took a delegation of power users to a local Windows show. When they saw a demonstration of Shapeware's Visio, they were hooked. And IntelliDraw was history. Is Visio a better, more usable application than IntelliDraw? For the only group that mattered, it was.

Lab tests tell only half the truth. The rest is up to you.

You've run your fair share of experiments on PCs and people, I'm sure. What's the most valuable lesson you've learned from the real world? Send your contributions to: Real World Lessons, *PC/Computing*, 950 Tower Lane, 20th Floor, Foster City, CA 94404. We'll print the best responses in a future issue.

PHOTOGRAPH BY RICHARD HOEGLER/STEPS

"This is a fast, beautifully designed PC with an upgrade path that just won't quit. That spells Best Buy to us."

–*PC World,* February 1993 Best Buy

"An array of features to make a user's mouth water."

–*PC Magazine,* January 26, 1993

*"...look at ZEOS's new 486DX2-66...*That's *value pricing."*

–Jim Seymour, *PC Magazine* Feb. 9, 1993

"Kudos for its excellent motherboard design, great performance, and thoughtful little extras... These features set the ZEOS apart from the crowd."

–*PC Computing,* March 1993, Best Value

The Word Is Out.

"ZEOS' engineering and quality advantages... clearly distinguish the ZEOS product from similarly priced machines."

–*Forbes,* March 1, 1993,

"...blew all competitors away–in some cases performing more than ten times as fast as competitors."

–*PC Magazine,* January 26, 1993

"The ZEOS is the fastest 33-MHz 486DX system we tested, and its performance even topped that of two 50-MHz 486DX2s."

–*PC World,* February 1993, Best Buy

Circle 139 on reader service card.

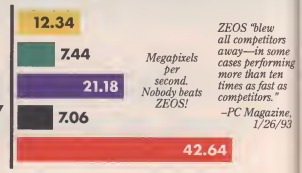
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Local bus is the hottest performance enhancement going. It speeds your computer's performance by allowing peripherals—like video controllers and IDE disk drives—to connect *directly* to the CPU's bus, transferring data at full clock speed.

Your new ZEOS system features *two VESA-standard local bus slots.* VESA-standard is important—you know you won't get stuck with some proprietary architecture that has no future. Check the competition; few meet the standard.

And ZEOS gives you *incredible* local bus video. *PC Magazine* tested a ZEOS system with our optional Viper video card. Their findings? The ZEOS *"blew all competitors away — in some cases performing more than ten times as fast as competitors."* This same #1-rated blazing Windows performance can be yours. Only from ZEOS!

PC MAGAZINE LABS BENCHMARK TESTS: GRAPHICS WINMARK



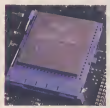
ZEOS "blew all competitors away—in some cases performing more than ten times as fast as competitors."
–PC Magazine, 1/26/93

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"IT'S HARD TO IMAGINE A BRIGHTER UPGRADE PICTURE." —*PC WORLD*

Now you can upgrade from any 486 as your needs change. You get more than just an overdrive socket—you get *upgradability all the way to Intel's Pentium™-based OverDrive® processor.* And your ZIF (Zero Insertion Force) socket makes it so easy!

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If you spend as much time with your PC as we think you do, you know what a difference high-quality components can make. Such as *strong cases, floppy drives by Teac, and .28mm dot pitch SVGA monitors that are non-interlaced all the way up to 1024x768 resolution.*

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We take Pkg. I and upgrade ta 4MB RAM, add an external 3.5" floppy drive, DOS, Windows and Lotus Organizer!

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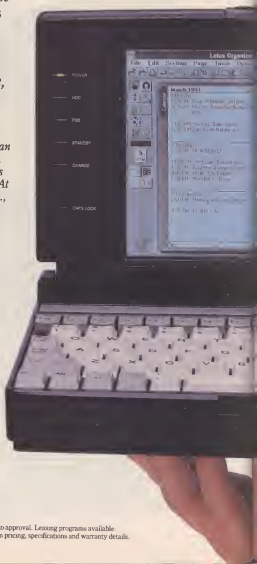
PC Week calls the ZEOS Contenda "the best yet of the new crop of lightweight, full-featured machines." We weren't satisfied with "best yet"—so we've made it *even better.* Because now you get your choice of a 386SL or 486SL CPU!

FEATURES THAT PULL NO PUNCHES.

Start by checking out the 386SL. The specs are on the left. It's impossible to find a notebook on the market today that's this light, this small, this affordable—and still gives you *so much power.* But it's all here.

For instance, there's the smart SL processor. According to *PC Magazine,* when it comes to notebooks, look for Intel's SL processor. The ZEOS Contenda's CPU extends your battery life significantly—because it's intelligent enough to power-down the memory, disks, modem and more when they're not in use.

What's more, its features make it a pleasure to use. Such as a crisp, vibrant VGA backlit screen. A built-in track ball. Enough power and memory to easily run Windows. And at less than 4 pounds in weight, it's probably lighter than your briefcase!



Smaller than a notebook, powerful as a desktop. At only 3.9 lbs., the ZEOS Contenda keeps you light on your feet.

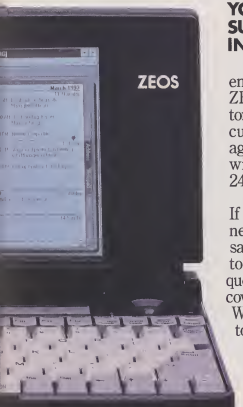
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- Hard Drive: 80MB
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- 512K 3.3v video RAM
- Local bus videa cantraller aperating at 3.3v
- Battery: NiMH; aperating time up to 5 haurs with power management
- Size: 9.7" x 6.1"
- Weight: Only 3.9 lbs.
- Pawer Management: Fully featured, including Deturbo, Standby and Suspend to disk
- Keyboard: Comfortable 80-key with embedded numeric keypad
- I/O Parts: 1 serial and 1 parallel standard; parts far aptional internal madem, external 3.5" floppy and external calar VGA ar SVGA manitor
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Digital brightness and contrast buttons make screen adjustment so easy.

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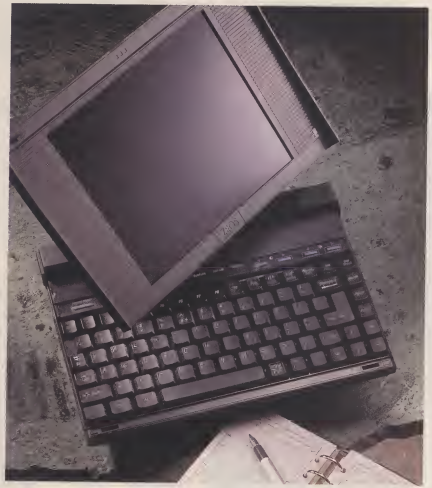
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We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power *and* great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

SL POWER. SL BATTERY LIFE. 64K CACHE!

We listened well. Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.

And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be "quick-charged" when the system is not being used, or trickle-charged when in use. So what happens when the power is on?



GREAT VIDEO TOO.

You get great video! Because for video control, we chose the amazing new Cirrus Logic VGA controller. It not only consumes less power, it also produces the fast crisp images you're looking for. And with a business machine like this you'll also appreciate our dual display capabilities. You can connect an external VGA color monitor for simultaneous display. And that's not all.

Built-in mouse key provides easy cursor control. Leave those bulky mice behind!



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We re-designed and re-sculpted every key from scratch. Even the key-switch mechanism was invented anew. And we added the mouse key for easy cursor control. It is the absolute perfect notebook keyboard. What else?

Lots else! Like the best display system of any notebook available anywhere. We listened here too. The screen is big and easy to read. Plus, it's high contrast and it's fast. It's also very easy to adjust. People said contrast and brightness knobs were hard to use. So we replaced them with soft touch buttons that *electronically* adjust screen settings at your command. Then we really got creative.

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THE ONLY NOTEBOOK WITH A TILT & SWIVEL DISPLAY.

Can you imagine your desktop PC without a tilt and swivel display? Neither could we. So why not incorporate that feature into a notebook. With the ZEOS Freestyle/SL notebook you can adjust the screen left and right as well as tilt it up and down. Now you can truly adjust your notebook screen to the perfect viewing angle.

IT FLOATS TOO.

And then there is the "floating" screen. When you're facing your new ZEOS Freestyle/SL, the screen actually appears to "float" in the air in front of you. It's the only notebook that can really be used sitting on your lap!

EXTRA, EXTRA, EXTRAS. READ ALL ABOUT 'EM!

We've made more options available than ever before. Like our modem with send/receive fax. And memory up to 20MB, hard drives to 180MB, even an optional Italian leather carrying case! Extra batteries and a charging stand are available too. Call 800-554-5218 for all the details.

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Examining the Substance Of Our Ratings

Big score for field guide, tears for Gates, and a word from wonks

The Lowdown on Local Bus

I was taken aback by your March cover story about the speed of local-bus video as measured by ZD Labs' Winmark utility ("Fastest PCs Ever: Windows at Warp Speed," page 100). Recent trade press articles have accused video manufacturers of cheating on benchmark tests like Winmark. I have to question any review that bases the value of local bus solely upon a test that can be so easily manipulated. Please don't continue to be taken in by manufacturers who distort reality by optimizing their video drivers to gain high Winmark scores.

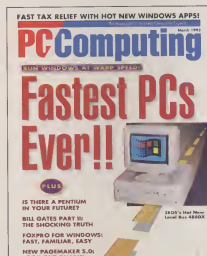
CHUCK LARRIEU
VIA MCI MAIL

We can't say for certain whether vendors are optimizing their cards for Winmark or any other benchmark test, but we have always taken lab benchmark tests with a grain of salt. That's why we run real-world application tests using programs like Lotus 1-2-3 for DOS and Microsoft Word for Windows, as well as lab benchmarks, on the systems we write about. This point is usually explicitly made, as it was on page 110 of the review of local-bus systems. We included a bar chart of Winmark results on page 102, but only after they corroborated what we found in the application tests. —Wendy Taylor

How did the Zeos 486DX2-66 beat out the Sirius SST 486DX2-66LBC for Best Value honors? You described the Zeos's video system as "migraine inducing" in the review, but rated it a 1 (excellent) in the table. You said nothing negative about the Sirius system's video, yet in the table you rated its video performance a 2. Additionally, the ergonomics and design of the Sirius system rated a 3, yet the Sirius has a better floppy drive layout than any of the other systems. In contrast, the Zeos's 3½-inch drive sits so low that it's blocked by the keyboard. The Sirius system also had the lowest price of any system tested.

DAVID RITTERBUSCH
PEORIA, ARIZONA

The "excellent" rating the Zeos received was for video performance. The Zeos



system uses a video adapter based on the Weitek Power 9000 chip, and we found its video speed to be first-rate. It was measurably faster than the Sirius S3 86C805-based video adapter. The 14-inch monitor that comes with Zeos's system was indeed migraine-inducing; we recommended buying a third-party monitor or spending an additional $125 for Zeos's 15-inch model, which supports higher refresh rates. Several design features make the Zeos a Best Value: an easily upgradable ZIF socket for Intel's forthcoming P24T OverDrive processor, flash BIOS, a single 8MB SIMM (with three open SIMM slots), and a local-bus SCSI upgrade option built onto the motherboard. We thought these benefits outweighed the placement of Zeos's 3½-inch floppy drive (which can be installed in the upper floppy bay if you prefer). —Wendy Taylor

You reviewed the Gecco 486VL-66E from Gecco Computers of Tempe, Arizona, but Gecco Computers went out of business in January. Is the system still available?

RONNIE RECORD
NAPA, CALIFORNIA

A casualty of the recent PC price wars, Gecco Computers folded after our March issue went to press. No other company has emerged to take its place, and no one else is selling the 486VL-66E system. —Wendy Taylor

Chip Guide a Hit

Bravo! Your "Field Guide to CPUs" (March, page 123) was great. I love the idea of having baseball cards for CPUs. I learned a lot in just a few minutes and envision endless possibilities for future issues. Maybe next time you could do a field guide to BIOS chips or even motherboards. Please keep the format—it allows me to cut each one out and mount it on an index card!

DAMON GIBSON
SEFFNER, FLORIDA

Of special interest to me was the Cyrix CX486DRu^2 on page 130 of the March

"I'm no idiot. I can see that 3,000 visitors a day at $10 a head adds up. I can only imagine how much they make from food sales and other stuff like those life-size posters of yours truly. All I ask is that they take good care of all the money that I'm working so hard for."

Name: Magilla
Title: The Boss / "The Ultimate Primate"
Company: The New City Zoo
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issue. I could not find an address and telephone number for the manufacturer, and I wonder if you could supply them.

JOE SWINIARSKI
CALGARY, CANADA

Cyrix Corporation is at 2703 N. Central Expressway, Richardson, TX 75080. You can reach the company by phone at (800) 848-2979 or (214) 994-8387.

—Liesl La Grange

Gates: A Crybaby?

Why is it that every time I read a book about someone important to the computer industry (Part Two of your excerpts from *Gates: How Microsoft's Mogul Reinvented an Industry—and Made Himself the Richest Man in America*, March, page 156), the author describes him or her as a crybaby, a brat, inept, and spoiled? Perhaps Bill Gates and Steve Jobs are all these things, but why do their biographers persist in such petty maligning of their subjects? Why is someone else in the company always "the brains behind the project"? All that's remembered about the celebration after the release of Windows is Gates getting so uninhibited that he shouted, "I want to get laid." The authors of such works start with an opinion and then write a book to support it. Why not just tell us the story and let us make up our own minds?

JAMIE WAKEFIELD
MIDDLEBURY, VERMONT

Considering that Windows didn't ship for two years after its initial announcement, "I want to get laid" may well be remembered as Bill Gates's most accurate statement of the era. But "crybaby"? "Brat"? "Inept"? "Spoiled"? Not one of those terms appeared in PC/Computing*'s excerpts from* Gates*, and we deliberately avoided glib characterizations of such complex characters as Gates and Jobs. We told the story; apparently you've made up your own mind.*

—Stephen Manes and Paul Andrews

TurboTax Slows Us Down

I read with interest "The PC/Computing FaceOff: TurboTax for Windows vs. TaxCut for Windows" (March, page 174), but I take issue with your findings: TurboTax is Turbo-Junk! I kept my patience with TurboTax when I discovered bugs in the headstart version; then I got the final version and it was just as flawed. Calling TurboTax's customer service was an exercise in futility. The one time I got through to ChipSoft, the person who answered confessed that she knew nothing about the program but that she'd have someone call me back right away. That was three weeks ago! In the time I spent messing around with TurboTax, I could have done my return the old-fashioned way—with a pencil. Next year it's TaxCut or nothing.

THOMAS TRIPP
FORT MYERS, FLORIDA

Although I agree with your assessment of the software capabilities of TurboTax and TaxCut, you're telling only half the story. One of the most compelling factors in choosing a tax package is the quality of the vendor's electronic filing service. How does TurboTax handle electronic filing? There are a number of ways you can transmit your return, and I chose ChipSoft's own BBS, thinking it would be the most direct and the fastest route. Three weeks later, my return has still not been filed with the IRS. Next year, I hope that your evaluation will take into account the electronic filing services of the products you review.

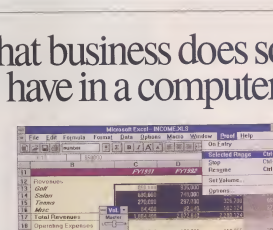
ROBERT J. WARDLOW
DUBUQUE, IOWA

Wonks Speak Out

Thanks so much for Gil Schwartz's "One Wonk's Evolution" (March, page 198). I do my billing, prescription tracking, and scheduling on an IBM PS/2 Model 70 running Wallaby's Resident under the Unix-like SCO system V/386. I delight in freaking out the service and training people by diving into the system at kernel level and playing games with the utilities—they're not real happy to discover that a doctor can be a wonk, too.

RICHARD BARTUCCI
WILLIAMSTOWN, NEW JERSEY

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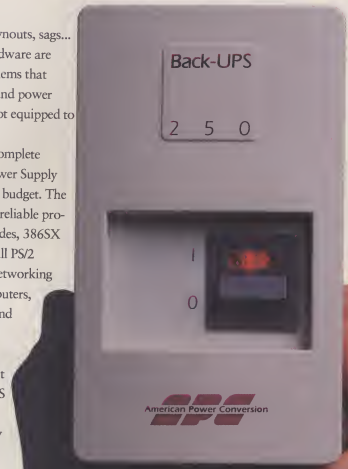
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Many thanks to Gil Schwartz for finally giving me a label I can wear with pride. When I showed my wife his definitions of a wonk, she acknowledged, "That's you all right!" When I think of the years and tears I've put into attaining this rank, I know it's time to stand up and be counted. I've bailed out many former critics from countless computer messes, and they're increasingly recognizing the need for us wonks.

DENNIS WAITE
LITTLETON, COLORADO

I feel an alarming empathy for Gil Schwartz. When I read "One Wonk's Evolution," I felt like he had ghost-written my autobiography, from the Kaypro II right up to the 486/50 that makes my wife jealous. Perhaps he could talk to her for me and try to make her understand. She just doesn't speak wonk!

HOWARD A. NUNES
BOSTON, MASSACHUSETTS

Not the Ultimate

I've been researching the ultimate tape backup drive and looked forward to Ron White's account of his own quest ("The Ultimate Tape Backup Drive," March, page 206). I was surprised that he chose Back-It for Windows as his third-party backup software, since it runs in single direct memory access (DMA) mode—accounting for his abysmal transfer times in some tests. In single DMA mode, data is read into memory, then written out to the tape drive; in dual mode, data is transferred directly from disk to tape. Also, Back-It for Windows does not support Quick File Access, which means that to restore file number 6,924, you must spool past the first 6,923 files on the tape to get to it. This would take about a week with Ron's setup.

BOB KERTESZ
LOS ANGELES, CALIFORNIA

There are increasingly few DOS programs I'm comfortable running these days. That's why I didn't even consider a non-Windows backup program. For the most part, I haven't regretted it because I rarely back up during normal business hours. Gazelle Systems, by the way, is sending a new version of Back-It for Windows that's supposed to fix some of the problems I experienced.
—Ron White

To Cache or Not to Cache

We read with interest "Consultant's Notebook: 10 Expert Tips for Buying the Right Network Server" (April, page 218), and were amazed by the author's assertion that caching controllers should not be used in NetWare file servers. Over the last decade hundreds of thousands of our caching controllers have been installed in file servers worldwide, improving system performance and accumulating literally billions of hours of reliable on-line service.

Customers buy our controllers because of the tremendous increase in performance they experience using our hardware caching in multiuser environments. This is no accident. Our hardware cache has been specifically designed to complement, rather than duplicate, the software caching algorithms implemented in NetWare and Unix, and offers a significant increase in performance over software caching alone.

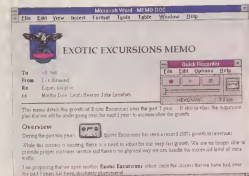
Computer manufacturers such as AST, NEC, Dell, Wyse, Intel, Siemens, and AT&T/NCR use our caching controllers as the standard offering in their high-end servers. In fact, the director of information systems at Ziff-Davis has been using DPT caching controllers in your magazine's corporate file servers for some time now and reports great performance and top reliability.

DAVID RACE
VP MARKETING
DISTRIBUTED PROCESSING TECHNOLOGY
MAITLAND, FLORIDA

Our statements about caching disk controllers definitely require clarification. Buyers have a broad choice of caching controllers; the critical issues in network implementations are safety and performance.

Our categorical statement that write-delay caches can corrupt data was overly broad. In fact, Novell has tested and certified caching controllers from three different companies for use with NetWare, including models from DPT,

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UltraStor, and Mylex. If the caching controller you purchase is NetWare-certified, it will be safe for use in a file server. Performance assessment is not so cut-and-dried. While NetWare certification guarantees compatibility, it does not promise performance gains, which require a well-implemented caching algorithm and the right environment. In some network installations, a caching controller can improve performance tremendously; in others, there may be no performance gains.

Our advice to network buyers is to review your system's specifications with a NetWare expert and get a recommendation on what will work for your configuration. —*Adam Meyerson*

Old PCs Never Die

Don't tell anyone, or let them believe that it is acceptable, to donate an original PC or XT to a charitable or other nonprofit organization without supporting that gift ("From the 8088 to the Pentium—It All Works According to Bott's Law," March, page 18). Non-profits may have computing requirements as great as those of any other company. Please support donations you make with necessary hardware upgrades and software.

FRANCIS H. KITTREDGE
TUCSON, ARIZONA

Where I work, I seem to be the low man on the totem pole, so I get the second-hand computers and peripherals no one else wants. I've upgraded them as best I can, and I dedicate each to its own task: One attends to my building-management program, another holds my reference data, and a third—an old XT laptop—holds my traveling data. True multitasking: a computer for each task. Nothing makes you stretch your skills to the limit like having access to less technology than you want.

MICHAEL P. GLENN
SCHENECTADY, NEW YORK

Send Money for Lou's Laptop

I was stunned to read about the horrible disaster described by Penn Jillette in his March 1993 column ("First Ever: Real Info on the Back Page," page 318). Something must be done immediately! The IBM world can't afford to lose a name as well known as Lou Reed's to the lowly Mac. What if each reader of *PC/Computing* sends me $5 and we use the money to buy Lou the laptop of his choice?

STEPHEN L. KLICK
KANSAS CITY, KANSAS

Corrections

In the February DOS column ("Techniques That Take Batch Files Beyond the Basics," page 336), we printed an incorrect listing for the program INKEY.COM. The correct code follows:

```
N INKEY.COM
E 0100 B4 08 CD 21 B4 4C CD 21
E 0108 C3
RCX
0009
W
Q
```

We regret any inconvenience the error may have caused.

The photograph of Bill Gates and Paul Allen on page 157 of the March issue should have been credited to Barry Wong, Copyright the Seattle Times. *We apologize for the error.*

A review of the program launcher HotWin in April's "A Better Windows Than Windows" (page 110) contained an incorrect version number and incorrect vendor information. HotWin 3.0 is available for $59.95 from TMA Software, 520 Washington St., Suite 148, Marina Del Rey, CA 90292, (800) 497-3617, or (310) 827-8932.

Pixar's phone number in May New! (page 66) is incorrect. The correct number is (800) 888-9856.

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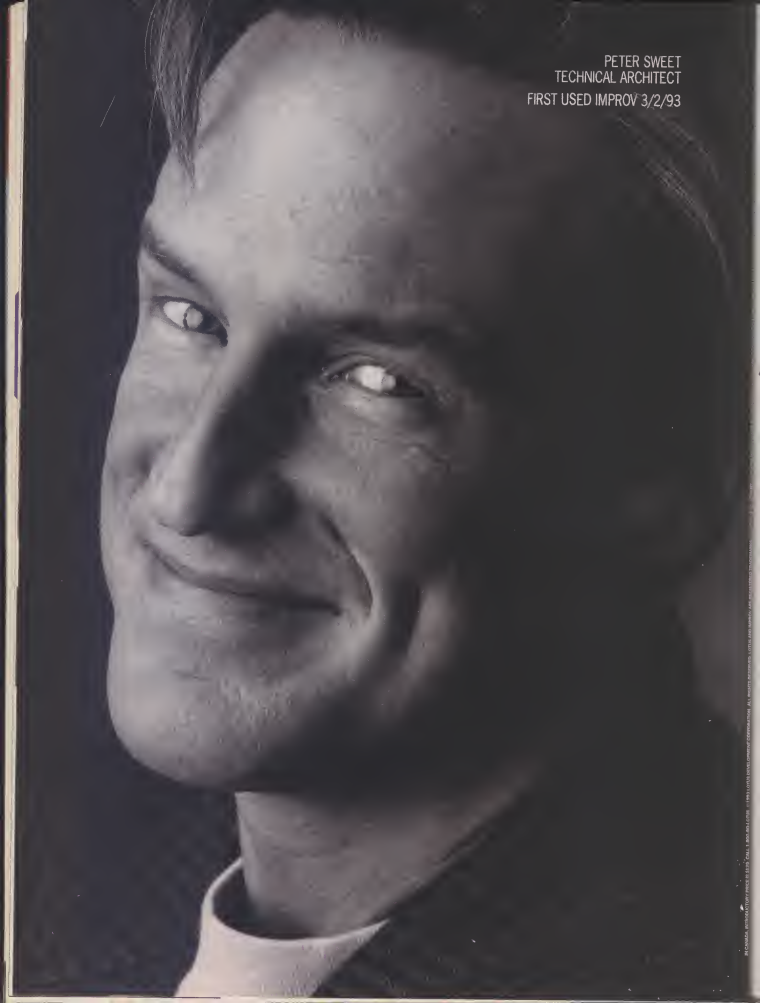
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THE WORLD'S FIRST DYNAMIC SPREADSHEET FOR WINDOWS, IMPROV WILL DRAMATICALLY ALTER THE WAY YOU LOOK AT, AND WORK WITH, SPREADSHEETS. WITH ITS DYNAMIC VIEWS, IMPROV LETS YOU INSTANTLY AND EFFORTLESSLY RESTRUCTURE WORKSHEETS TO HELP YOU GAIN NEW PERSPECTIVES ON YOUR WORK. ALL AT THE TOUCH OF YOUR MOUSE. IT'S A SIMPLE ONE-CLICK MANEUVER FOR IMPROV THAT REPLACES HOURS OR DAYS OF RECALCULATING AND REBUILDING WITH A TRADITIONAL SPREADSHEET.

AND UNLIKE CONVENTIONAL SPREADSHEETS, IMPROV DOESN'T MAKE YOU WORK IN CRYPTIC CODES. YOU EXPRESS YOUR FORMULAS IN PLAIN ENGLISH (GROSS MARGIN = REVENUE – COST OF GOODS) THE SAME WAY YOU EXPRESS YOURSELF IN BUSINESS.

IT'S NOT ONLY AN EASIER WAY TO WORK THAN TRADITIONAL CELL-BASED FORMULAS (C6–D5), IT'S SELF-DOCUMENTING. SINCE ALL LABELS AND FORMULAS ARE IN ENGLISH, THE SPREADSHEET IS SIMPLE FOR ANYONE TO READ AND FOLLOW. EVEN MONTHS LATER. AND, BECAUSE THESE FORMULAS AREN'T LOCKED TO A SPECIFIC CELL ADDRESS, THEY CAN BE EASILY APPLIED TO MANY CELLS AT ONCE.

WITH THE INTRODUCTION OF IMPROV, LOTUS HAS AGAIN MOVED THE WINDOWS™ PLATFORM TO A NEW LEVEL OF EASE AND USABILITY. IF YOU'RE SPENDING A LOT OF YOUR TIME REBUILDING SPREADSHEETS AND MOVING DATA AROUND TO GET DIFFERENT VIEWS, THIS MOVE WILL IMPROVE THE WAY YOU WORK.

ACCORDING TO INFOWORLD, "SERIOUS SPREADSHEET USERS...OWE IT TO THEMSELVES TO GET A COPY OF THIS $495 PACKAGE."[1] WITH A SPECIAL INTRODUCTORY PRICE OF $99;[2] YOU CAN'T AFFORD TO SIT IT OUT. BECAUSE ON JUNE 1, THE PRICE RETURNS TO $495.[3]



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1-2-3 and Windows:

LOTUS 1-2-3 RELEASE 4.0 FOR WINDOWS, $495, UPGRADE, $150 LOTUS DEVELOPMENT 55 CAMBRIDGE PKWY. CAMBRIDGE, MA 02142 (800) 343-5414

LOTUS 1-2-3 FOR WINDOWS is finally what it should have been in the first place: a good reason for DOS 1-2-3 users to upgrade.

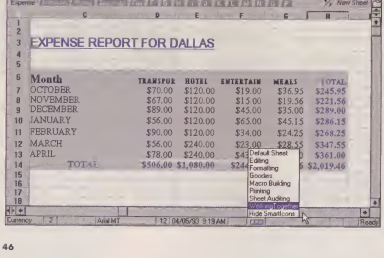
Will Version 4.0 topple Microsoft's venerable Excel for Windows or Borland's elegant Quattro Pro for Windows? No. The new 1-2-3 for Windows catches up to Microsoft's and Borland's spreadsheets (and borrows heavily from them) in important ways, but it's still missing significant features found in those products—and its $495 price tag is expensive. Still, our speed tests showed few differences among 1-2-3 for Windows, Excel, and Quattro Pro, and 1-2-3 for Windows' intelligent new interface defiantly stares down the product's stuck-in-the-DOS-past reputation.

Windows has made spreadsheets more approachable and flexible—especially for using multiple worksheets concurrently—and 1-2-3 for Windows now leverages Windows instead of being constricted by it. Finally, the old, kludgy 1-2-3 metaphor for consolidating multiple worksheets has been overhauled. In previous versions, to carry formulas and values across worksheets, you had to start with a cramped, tiered Perspective view of the worksheets. The problem with this 3-D view was that you could see only a tiny portion of each worksheet; it was a clumsy carryover from 1-2-3's DOS products. 1-2-3 for Windows 4.0, on the other hand, handles multiple worksheets using the clever tabbed-file-folder metaphor found in Borland's Quattro Pro for Windows.

TABBED FOLDERS

Like Borland's Quattro Pro for Windows, 1-2-3 for Windows 4.0 uses a tabbed folder metaphor for worksheets that makes it easy to consolidate data from multiple spreadsheets.

The pop-up menu at the bottom of the screen lists collections of SmartIcons you can swap in and out.



WHAT'S NEW IN THE LATEST 1-2-3 FOR WINDOWS?

- SmartIcons that launch and "work together" with other Lotus apps.
- Notebook metaphor, with tabbed file folders, for worksheets.
- Data Query Assistant for accessing external database data.
- Sharing/modeling work-group data sets via a Version Manager.

Icons and Integration

The SmartIcons in 1-2-3 for Windows are smarter, and Lotus's approach to swapping different toolbars in and out beats Excel's and Quattro Pro's. At the bottom of the screen in 1-2-3 for Windows, a miniature toolbar is displayed at all times. Click on it, and a menu pops up listing the following collections of icons: Default Sheet, Editing, Formatting, Goodies, Macro Building, Printing, Sheet Auditing, and Working Together. The Working Together SmartIcons let you launch other Lotus applications, such as Notes, Ami Pro, and cc:Mail.

In fact, integration with other Lotus programs is one of the best new additions to 1-2-3 for Windows; we especially liked the fact that a small envelope appeared to alert us to incoming Lotus Notes mail messages; clicking on the envelope sent us straight into Notes.

Happy Together at Last

You can also send mail from within 1-2-3, and attach spreadsheet files to mail messages. The spreadsheet is a viable front end for database data, too. Using a Data Query Assistant—which works like the Database Desktop in Quattro Pro for Windows—you can directly query external database data.

A charting SmartIcon allows you to easily create point-and-click charts. Just select a range of data to chart, click on the icon, and draw a square, and 1-2-3 for Windows builds your chart in the square. If you want to change the chart type, click the right mouse button on the chart and select Chart Type from a shortcut menu. As with Excel and Quattro Pro, you can pull up context-sensitive shortcut menus throughout 1-2-3 for Windows by clicking the right mouse button. In addition, you can easily move data and charts by dragging-and-dropping them.

Version Manager

1-2-3 for Windows' new Version Manager, which beats the Scenario Manager in Microsoft Excel, is a slick way to manage and experiment with different sets of numbers within the same fundamental worksheet. Version Manager stores different sets of data and lets you plug them into your worksheet by selecting each named set from a pick list.

For example, let's say you are looking at four numbers representing low income from four regions in the United States. Select Range Version from 1-2-3 for Windows' main menu, choose the Create button in the Version Manager dialog box, and name this set of numbers "Low Income." Then, plug a second set of numbers into the same cells and name it "Higher Income." The Version Manager will store your Low Income numbers and your Higher Income numbers in a pick list, so you or other networked users can point and shoot to plug either set into your spreadsheet.

You can group several sets of numbers into a scenario, so, for example, your marketing team can experiment with one scenario, while your finance department can access its own scenario. (See the Guided Tour on page 48 for an example.)

Room for Improvement

The verdict: 1-2-3 for Windows still isn't the best product in its class, but DOS 1-2-3 users finally have a capable Windows version to move to. Heavily formatted worksheets done in DOS versions of 1-2-3 were translated by 1-2-3 for Windows perfectly in our tests, and the Windows version's Classic menu—which lets DOS users employ familiar slash-*key* commands—remains a big attraction.

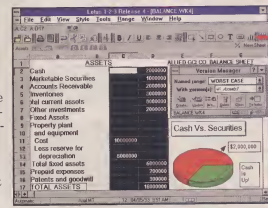
Excel and Quattro Pro for Windows are still the best buys in Windows spreadsheets. They include robust built-in facilities for creating presentations from spreadsheets, more flexible formatting choices via the right mouse button, and more chart options than 1-2-3 for Windows. Excel's Wizards, which interview you about tasks such as extracting database data in crosstab format, remain an unmatched leap forward in usability. Borland's Quattro Pro for Windows currently sells for $99.95—hands down the hottest bargain in Windows spreadsheets—and it earns the congeniality award for being the only Windows spreadsheet to support the file formats of its competitors.

1-2-3 for Windows has made dramatic progress, and the program is no longer a quirky carryover of 1-2-3 for DOS. We can't yet endorse it as the best product in its class, but one thing's for sure: The Windows spreadsheet competition is now a three-way race.

SEBASTIAN RUPLEY

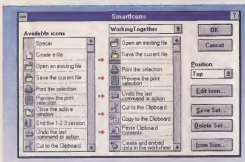
QUICK CHARTS

The icon represented by a bar chart (far right) in the screen belaw provides an extremely simple way ta create a chart. Just select the data you want charted, dick on the icon, and draw a square. 1-2-3 for Windows will autamatically generate a complete chart. Ta custamize it (ta change the chare type ar background calar, for example), dick the right mause buttan an the part af the chart you want ta change. As with Excel and Quattro Pra, you can dick the right mause button an any part af a worksheet ta customize farmats.



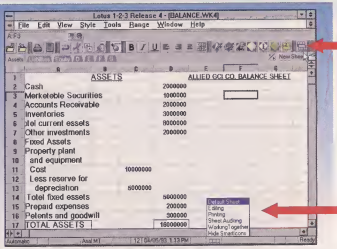
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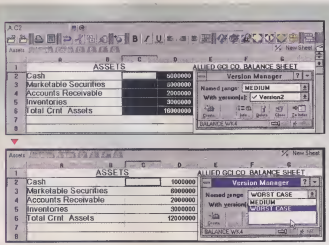
1-2-3 for Windows—More Flexible SmartIcons, Work-Group Power



1. SmartIcons Galore

SmortIcons in 1-2-3 for Windows ore more plentiful and clever thon in ony other Lotus product. You con switch collections in ond out by clicking on the right side of the toolbor or pop-up menu (see right), ond you con sove custom collections (see obove).





2. Version Manager

This set of numbers (top) wos nomed ond soved in the Version Monoger os Medium.

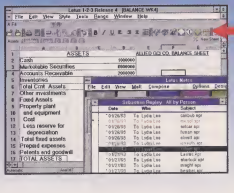
By choosing Worst Cose (bottom) from the Version Monoger's pick list of doto sets, we outomotically plugged in lower numbers. For experimenting with different volues in lorge worksheets, the Version Monoger is o reol time-sover.

In oddition, the Version Monoger con keep trock of who creoted ony given doto set in o work group. Thus, different deportments con eosily shore different worksheet versions, ond group mony versions together into "scenorios."

3. Notes, Mail, and Application Integration

In keeping with Lotus's Working Together strotegy, 1-2-3 for Windows comes with o collection of SmortIcons colled Working Together. Use these icons to lounch Lotus opplicotions such os Notes, Freelonce Grophics, or cc:Moil. If you use Notes or cc:Moil, you con be notified of incoming moil while in 1-2-3 for Windows, ond you con poinlessly send spreodsheet files ocross o LAN vio e-moil.

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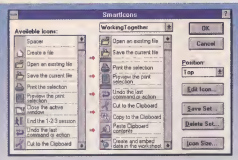


PULL HERE


Don't Open Until 1994
To: PC Buyers
From: Your friends at Gateway 2000

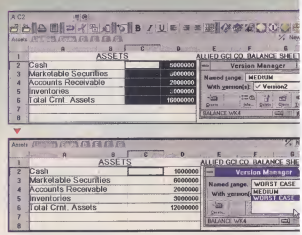
New!

1-2-3 for Win
SmartIcons, W



1. SmartIcons Galore

SmartIcons in 1-2-3 for Windows are more plentiful and clever than in any other Lotus product. You can switch collections in and out by clicking on the right side of the toolbar or pop-up menu (see right), and you can save custom collections (see above).



3. Notes, Mail, and Application Integratio

In keeping with Lotus's Working Together strategy, 1-2-3 fo Windows comes with a collection of SmartIcons called Wor Together. Use these icons to launch Lotus applications such Notes, Freelance Graphics, or cc:Mail. If you use Notes or cc:Mail, you can be notified of incoming mail while in 1-2-3 Windows, and you can painlessly send spreadsheet files oc o LAN vio e-mail.

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We K

With Gateway's Pentium™ Technology Guarantee, You Have A Good Reason To Celebrate!

If you've been worried about keeping up with technology now that Intel's® Pentium processor has been announced, relax! Kick back and join the Gateway 2000 486 Fest, featuring great buys on 486 systems and our Pentium Technology Guarantee. It's a Gateway-exclusive offer that allows you to keep up with technology *and* save big bucks when you buy a Gateway 486 Pentium technology ready system this summer!



Guaranteed Upgradeability

We *guarantee* you can upgrade your Gateway 486 Pentium technology ready system to future Pentium processor technology products in 1994. This next-generation OverDrive processor will easily plug right into the ZIF (zero insertion force) socket already installed on your upgradeable Gateway 2000 system with no modifications. And, unlike many manufacturers, we've already had our systems heat tested for use with Pentium technology processors.

Guaranteed Performance

We *guarantee* your upgrade to Pentium technology will accelerate overall system performance by 50 to 100%. It's likely that your upgraded 486 system will outperform Pentium systems on the market today.

Animal!



Guaranteed Price

We *guarantee* we'll sell you this 1994 upgrade at the best market price. At press time for this ad, we didn't have enough information to quote a price, but you can be sure it'll be terrific, possibly as low as $500. Call for details! The Pentium technology price guarantee is for a limited time only. If you purchase a Gateway 2000 Pentium technology ready system by August 15, 1993, you'll receive a written price guarantee for the processor you can buy in 1994.

Guaranteed Availability

We *guarantee* you can be among the first to get this next-generation OverDrive processor when it goes on the market. When you buy your 486 Pentium technology ready system this summer, you'll receive a personal upgrade reservation number. It's your guarantee of a special place in line to acquire this next-generation OverDrive processor when it ships in 1994. Our supply of upgrade processors will be offered in sequence to customers holding these reservation numbers. The sooner you buy your 486 system, the sooner you can get your OverDrive.

Get A Gateway During 486 Fest — It's The Smart Technology Move

When you buy a Gateway 2000 Pentium technology ready system during 486 Fest, you're investing in your technology future for a fraction of what you would pay for a Pentium-based system today.

Aren't you glad you peeked at our gift? Now you know Gateway 2000 offers the best value — today *and* tomorrow.

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Party Reason — *If you pick a mini desktop, you'll save enough to invite the whole barnyard to your party.*

Gateway's mini-desktop systems — 4SX-25, 4SX-33 and 4DX-33 — are petite but powerful, based on an integrated design that incorporates many subsystems on the motherboard for the best price-performance ratio. All mini desktop systems include: 4 to 8MB RAM; a large and fast hard drive, operating on the local bus for even faster drive performance; a fast video chipset with 1MB; a brilliant, crisp display from the standard 14-inch CrystalScan™ non-interlaced, .28mm dot pitch color monitor; and more available expansion slots than you find in most small-footprint PCs. The combination of these features makes a cool Windows™



w You Couldn't Wait, You Party



PULL
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Don't Open
Until 1994



To: PC Buyers

From: Your friends at Gateway 2000

More Reasons To Go Hog-Wild Durin

Need a reason to celebrate? We're making this the best summer ever to buy a Gateway PC! During our 486 Fest, you'll find better-than-ever buys on all the fabulous systems in our product line. You'll think you died and went to hog heaven! Buy some fiesta goodies, invite a few party animals over and call us. We'll give you lots of reasons to party!

Party Reason — *Choosing a 486 system shows you're a smart buyer!*

A less astute buyer might go for a 386 or Pentium™ system, but you know where the real value is. Gateway 2000's desktop and Nomad PCs are now all 486 systems for good reason. With our great prices on 486 technology, 386 systems are no longer a smart buy. And first-generation Pentium systems are not a good value.

Even if you were willing to pay the steep premium other manufacturers are charging for Pentium systems, you'd have trouble getting one because availability is extremely limited. Our engineers say the Pentium systems in our lab run so hot, you could use one to heat a hog barn. Besides, Pentium systems on the market today will be outperformed quickly by improvements in Pentium technology. That's why we're not selling Pentium systems yet. At Gateway, we won't sell anything unless it's a good value for you.

In today's market a 486 machine is the way to go, especially now that all of our desktop ISA systems are Pentium technology ready and guaranteed to be upgradeable.

Party Reason — *If you pick a mini desktop, you'll save enough to invite the whole barnyard to your party.*

Gateway's mini-desktop systems — 4SX-25, 4SX-33 and 4DX-33 — are petite but powerful, based on an integrated design that incorporates many subsystems on the motherboard for the best price-performance ratio. All mini desktop systems include: 4 to 8MB RAM; a large and fast hard drive, operating on the local bus for even faster drive performance; a fast video chipset with 1MB; a brilliant, crisp display from the standard 14-inch CrystalScan™ non-interlaced, .28mm dot pitch color monitor; and more available expansion slots than you find in most small-footprint PCs. The combination of these features makes a cool Windows™



ateway's 486 Fest!

machine for an unbeatable price. Now that's cause for celebration!

Party Reason — *You'll be wallowing in ecstasy if you buy a local bus system.*

Go ahead and splurge on our 4DX2-50V or 4DX2-66V models. We put ATI's™ Graphics Ultra Pro video card with 1MB VRAM on our VESA® local bus for results that will be the hit of your party.

Gateway 2000 486 Fest

Plus, these systems have a hefty 8 or 16MB RAM with cache, and party-hearty hard drives running on the local bus. You get an extra VESA local bus expansion slot, a 15-inch flat, square CrystalScan color monitor, and more free choices of application software than you'll find anywhere else.

Party Reason — *You'll get the CD-ROM drive you always wanted.*

It's included with our 4DX2-66 systems! Or you can upgrade any other standard configuration with a CD-ROM. We supply a free system CD when you purchase a PC with a CD-ROM drive. The CD includes Microsoft's® Multimedia Pack,™ designed to let you explore the value of multimedia technology. You get an interactive user's guide to Windows and a collection of sound, animation and video clips to use in business presentations and documents.

Party Reason— *You can have it your way at Gateway.*

We custom build each Gateway 2000 computer to your order. We'll gladly provide you with a quote on a special configuration. Call our sales department!

Party Reason — *You'll save money!*

Check the configurations and prices on the back page of this ad. We've gone hog-wild for 486 Fest!

Party Reason — *The wrappings!*

Your Gateway system comes in a black-and-white cow-spotted box. Some people use our boxes for end tables and playroom furniture. It will certainly be a conversation-starter at your party.

Party Reason — *Get our 486 Fest Best Buy!*

Check the back page of this ad for an unbelievably good buy on a smart 4DX2-66 local bus system configuration including 8MB RAM, 340MB hard drive and CD-ROM for only **$2495!**

The Gateway 2000 4DX2-50V at $2295 is a favorite with our three little pigs.



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Party On With Value-Priced Portable

Keep counting the reasons to celebrate during Gateway's 486 Fest! You'll find plenty when you look at our Nomad notebook PCs and computer peripherals!

Nomad Notebooks

Party Reason — *You'll get 486 desktop performance in a lightweight portable when you buy a Nomad.*

Why settle for a 386 notebook when you can get a powerful 486 Nomad in the same price range? All three Gateway 2000 Nomad models are 486 systems with snappy performance that's still rare in notebooks. Plus, they're smaller than many notebooks, weighing just 5.6 pounds and measuring 8.5" x 11" x 1.8". No other notebook this size can beat the Nomad 450DXL's combination of performance and battery life! In *PC Magazine's* Battery Rundown Test, Nomad systems operated up to six hours on a single battery with power management enabled.

Party Reason — *No more squinting at a dim and fuzzy display!*

Nomad screens are big and brilliant — a full 10" VGA backlit display with 64 gray scale. You can use your Nomad in all lighting conditions.

Party Reason — *Three cheers for a great keyboard and mouse!*

Nice feel! The 79-key touch-type keyboard is comfortable, quiet and fast. Nomad 450DXL models now also include Microsoft's® Ballpoint™ portable mouse with Quickport,™ standard.

We have lots of options for our Nomads, too. Call for details!

Peripherals

Party Reason — *You'll save money on connectivity tools!*

TelePath™ Fax/Modem. It's everything you ever wanted in an internal fax/modem, including a great price! The Gateway 2000 TelePath is a 14,400bps modem, V.32bis, with 9,600bps fax capability. It's compatible with the standard AT command set and is downwardly compatible with lower modem speeds. Package includes software — WinFax Pro,® Crosstalk™ for Windows and Qmodem — plus a free CompuServe® trial membership. **$195**

Network Cards. Call for a selection of Ethernet cards and Token Ring adapters, installed and configured.

Microsoft Windows™ for WorkGroups. Networking made easy! Share files and printers, send electronic mail, schedule group meetings with the click of your mouse — and get everything you need in one inexpensive package. That's the beauty of Windows for Workgroups. Even a beginner can set up and configure a network with this fantastic product. Price includes an Ethernet adapter and software. Hardware and software are factory-installed. **$159**

Party Reason — *You'll save money on multimedia software and peripherals!*

CD-ROM Kit. You'll enter a whole new world of possibilities with your PC when you add a CD-ROM drive, giving you access to exciting new applications, databases and entertainment programs. With applications continually getting bigger, wouldn't it be convenient to get software on a single CD rather than piles of floppy disks?



Get galloping portability on your road trips with Gateway's top-of-the-line Nomad 450DXL.

intel inside

...nd Peripherals!

Comparable CD-ROM drives usually retail for over $400. Manufactured specially for Gateway 2000, this kit includes CD-ROM, interface card and everything you need to add MPC-compliant CD-ROM to your PC. **$225**

Microsoft Windows Sound System.™ Here's the sound system designed for business, complete with a headset for private office use. You can "speak" commands to your PC for hands-free operation. Let your PC read numbers back to you for proofing spreadsheets. Embed audio messages in Windows OLE applications. Add audio to screen savers. Play your Ad Lib® and Sound Blaster™ games — and more! Our special Gateway price includes soundboard, microphone, headset and software. **$149**

Party Reason — *You'll save money on all kinds of extras from Gateway!*

Colorado Memory Systems™ TBU. 250MB internal automatic tape backup unit copies up to 9.5MB per minute with high-speed data compression. Reads previously formatted Archive™ tapes, too. Comes with easy-to-use DOS software, one tape and cable. 486 Fest price: **$195!**

CrystalScan™ 15-Inch Monitor. Non-interlaced color monitor with flat, square screen. If the system you want is advertised with a 14-inch monitor, you can upgrade at the time of purchase to a 15-inch monitor for only **$100.**

Panasonic® KXP2123 Color-Capable Printer. Add color to your documents with this 24-pin dot matrix printer. Includes Adobe Type Manager.® Call for 486 Fest price!

Texas Instruments® MicroLaser™ Plus Laser Printer. Never before has such a small, Postscript® laser printer offered so much speed and economy. The MicroLaser Plus is only 13.4" x 14.2", yet it prints 9 pages per minute at 300dpi. Call for 486 Fest price!

Gateway 2000
486 Fest

We offer many other system options and upgrades, including 17" and 20" monitors, tape backup units, bigger hard drives, other software and more! Call today!

The software and peripherals listed here are sold only with the purchase of a system. For details on our complete line of extras for Gateway customers, ask for our special add-on components division when you call.



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Celebrate! We Give You More Softwar

That's right! We have even more reasons to party during Gateway's 486 Fest! We offer more free choices of application software with our systems than any other manufacturer. Plus, all software is pre-installed and ready to run the moment your system arrives. Hooray! No installation hassles!

With Nomad, mini desktop and our 4DX2-66 Best Buy systems, you get Works, one of the best integrated software packages on the market.

Party Reason — *Microsoft Works for Windows.*™

Works for Windows is the single program that combines all the tools you need to run a business: word processor, spreadsheet, database and electronic communications. It's simple to use yet provides power and functionality for advanced users.

With desktop and tower systems that include "choice of application software," you can select one of the following software packages. All applications are the latest versions.

Party Reason — *Microsoft Excel for Windows.*™

Microsoft Excel gives you unprecedented power and analytical functions, outstanding reporting and presentation tools, and easy charting. Includes faster ways to work. Reviewers consistently choose Excel as the best spreadsheet for Windows. It's an *InfoWorld* Product of the Year!



Party Reason — *Microsoft Word for Windows.*™

The original word-processing application for Windows is still the best selling! Drag and drop text and graphics around the page for easy creation of professional-looking documents. Existing WordPerfect® files (and other file formats) are usable in Word. You can even type a WordPerfect command and see Word's equivalent command automatically demonstrated on-screen!

Party Reason — *Microsoft Word and Bookshelf 92,® CD-ROM Edition.*

The most popular word processor for Windows now becomes the ultimate writing tool with an entire electronic reference library full of multimedia sights and sounds! Includes dictionary, encyclopedia, thesaurus, atlas, quotations, and more.

Party Reason — *Microsoft PowerPoint for Windows.*™

For easy, professional on-screen slide shows, overhead transparencies or 35mm slide presentations. Fast and flexible word processing, graphing, outlining and drawing tools give you more time to master your content instead of wrestling with your software.



hoices To Crow About!

Party Reason — *Microsoft Project for Windows.*™

Project management is easier and more flexible than ever! This program gives you the power and versatility to manage your schedules and resources more efficiently. That's why *PC Magazine*, *PC Week*, *PC World* and *Software Digest* call Project the best program in its category!

Party Reason — *The MS Entrepreneur Pack.*

Four great software packages in one! Microsoft Works,™ Publisher,™ Money™ and an Entertainment Pack.

Party Reason — *Borland Paradox® for Windows.*

Paradox for Windows is the relational database that makes a powerful database easy to use. Now you have complete access to data, plus all the tools you need to create graphical applications in no time. Paradox for Windows works with existing Paradox for DOS and dBASE files without modification.

Party Reason — *The Windows Programmer Pack.*

Get everything you need to create programs for Windows: Microsoft QuickC for Windows,™ Visual Basic for Windows,™ Windows Control Development Kit,™ Windows Help Compiler™ and Windows Programmer's On-Line Reference.™

Party Reason — *Upgrade to the CD-ROM Edition of Microsoft Office.*™

You can upgrade from a choice of application software to Microsoft Office, CD-ROM version, for only $99! This single package has all the leading Windows applications: Word, Excel and PowerPoint. The standard edition of MS Office is also available as an upgrade from a choice of application software for $175, or $499 as a second application.

Party Reason — *Upgrade from Works to choice of application.*

If the system you want comes with MS Works for Windows, you can upgrade to a choice of application software for only $100.

Software shown here is sold only with the purchase of a system. Software sold with systems includes the identical applications contained in retail packages but will not include the retail box. You get all master diskettes and manuals, shrink-wrapped and packaged in a Gateway 2000 box.

intel inside

Everyone's flocking to check out the life of the party, Gateway's 4DX2-66 Best Buy system shown with optional Labtec speakers.



GATEWAY2000

800-846-2062



The Whole Herd Is Dedicated To Pro

Yes, this is the whole gang at Gateway 2000. We now number in excess of 2,000 people. We gathered everyone together for this 486 Fest kick-off photo so you could see all the friends you have in the business, and so we could renew our commitment to your complete satisfaction.



Despite some blustery weather, Ted, our president and founder, gave us an inspiring pep talk about customer satisfaction and value. He reminded us that we will be the best in this industry only as long as we remember the guiding principles of our company, best described in our mission statement:

We are Gateway 2000.
We care about and respect you, our customers.
We pledge to you that we will be honest, courteous and friendly.
If we make a mistake, we will admit it.
If you're unhappy about something, we'll do everything in our power to make it right.
We'll treat you as an individual and take special care to see that your individual situation is handled fairly.
We have fun working together, striving to be the most knowledgeable, productive and successful team in the world.
We blend our talents to continually offer higher quality, more innovative and useful products, at a value unmatched by competitors.
We will always be happy but we will never be satisfied.
And we will continually improve everything we do.
We will succeed, together as a team.
We are Gateway 2000.
We are the only logical choice!

Gateway 2000
486 Fest



ing You With The Best Service!

Party Reason — *You'll like doing business with people who care about you!*

Each and every person in this photo rededicated his or her efforts to achieving these goals. Like a married couple going through a second wedding ceremony after many years of marriage, our energies were refocused on what's important. And what's important to us is *you*!

Party Reason — *You get excellent after-the-sale support!*

Every Gateway 2000 system comes with a **30-day money-back guarantee**. If you don't like your system, send it back within 30 days for a refund. All systems come with a **one-year limited warranty** and telephone **technical support** for the life of the system from our award-winning tech department. You also get an **automated fax service** to supply you with detailed documentation on over 150 technical subjects, and a **lifetime BBS membership** for additional technical support and online forums.

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Party Reason — *It's so easy! Just give us a call!*

We make it easy for you to buy a Gateway PC, with convenient payment options including major credit cards and C.O.D. terms. Net 30-day terms and leasing options are also available to qualified commercial customers.



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intel inside

BYTE

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GATEWAY2000

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- 25MHz 486SX Intel® Processor
- 4MB RAM
- 3.5" Diskette Drive
- 80MB 17ms IDE Hard Drive
- Local Bus IDE Interface
- **Intel Pentium™ Technology Ready**
- Windows Accelerated Video w/1MB DRAM
- 14" Color CrystalScan™ 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey™ Keyboard
- MS-DOS® 6, Diags, Windows™ & Mouse
- MS Works for Windows™ 2.0

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4SX-33

- 33MHz 486SX Intel Processor
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- Local Bus IDE Interface
- **Intel Pentium Technology Ready**
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- 14" Color CrystalScan 1024NI
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- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS 6, Diags, Windows & Mouse
- MS Works for Windows 2.0

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4DX-33

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- 3.5" Diskette Drive
- CD-ROM Drive
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- **Intel Pentium Technology Ready**
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- Desktop Case (Tower Upgrade)
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PC Computing, May 1993

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NETWORKING

Lexmark's Fast Network Printer: Much Cheaper than Compaq's, HP's

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JUST WHEN YOU thought Hewlett-Packard and Compaq ruled network printing, Lexmark makes it a three-way race. The IBM LaserPrinter 4039 16L packs the functionality of HP's LaserJet 4Si and Compaq's Pagemarq 20 into an extremely small footprint. Like its rivals, the 16L has advanced networking capabilities, including automatic switching between multiple network operating systems and direct network connections into the printer.

The 16L has the speed and capability to service a small-to-medium-size work group. The 16-page-per-minute engine excels at long documents that mix text and graphics. The 16L printed our 100-page Word for Windows document in 6 minutes and 37 seconds—25 percent faster than the LaserJet 4Si. Compaq's Pagemarq 20 was slightly faster than the 16L at printing text, but much slower than the HP and Lexmark printers at graphics.

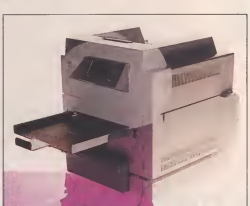
The Lexmark 16L costs just $3,399—compared to the LaserJet 4Si's $3,749 list price and the Pagemarq 20's $5,898 price. It's an especially good value considering that the Lexmark includes PCL 5 emulation and PostScript Level 1, whereas the LaserJet 4Si has only Enhanced PCL 5. HP does offer a PostScript Level 2 upgrade for $799.

The 16L includes fast bidirectional parallel and serial ports as well as an open interface slot for an ethernet, token-ring, or LocalTalk adapter. The initial release of the 16L supports NetWare, LAN Manager, LAN Server, and AIX networks. It ships with 52 resident fonts, 4MB of RAM, and a 500-sheet input drawer.

Lexmark's 16L also supports 600-by-600-dot-per-inch resolution in PostScript mode only. Printing at 600 dpi, however, seriously slows down the printer. Our PowerPoint test presentation took twice as long to print in 600-dpi mode as it did in 300 dpi, and the results weren't better enough to justify the wait.

The 16L is the best choice for printing long documents that mix text and occasional graphs or tables. Compaq's Pagemarq is fastest at text, and HP's 4Si shines at graphics, but the Lexmark 16L is the most balanced network printer.

CYNDY BATES



Lexmark's small-footprint IBM LaserPrinter 4039 16L hos o surprisingly low $3,399 price.

PRINTER BENCHMARKS:

HP'S 4SI IS FASTEST AT GRAPHICS; LEXMARK, COMPAQ WIN AT TEXT

Longer bars represent better performance relative to the HP LaserJet 4Si.

Product	Word for Windows (100-page document)	PowerPoint (graphics)
Lexmark 4039 16L (w/ PCL 5)	25% Faster	59% Slower
Lexmark 4039 16L (w/ PostScript)	7% Faster	16% Slower
Lexmark 4039 16L (w/ PostScript, 600 dpi)	NA	55% Slower
Compaq Pagemarq 20	26% Faster	78% Slower
Baseline HP LaserJet 4Si		

Unless otherwise noted, all tests were performed printing at 300 dpi.

$10 DOS 6.0 TRAINING

Quick, whot program do DELTREE, MOVE, ond POWER belong to? Answer: DOS. From new commonds like these to memory monogement, DOS 6.0 is full of new twists. The cheapest way to get up to speed with the new DOS is Individuol Softwore's (800-822-3522, 510-734-6767) one-disk program Fastrax to DOS 6.0. This well-organized, quick tour of new features costs a mere $9.95.

The progrom is nomed Fostrox becouse it's divided into three tracks you select from o moin menu. We found the program's Inside Track discussion of DOS 6.0's benefits tedious, but the Learning Trock is on extremely efficient tour of the new benefits, utilities, and commands. The Test Track drills you on using the new features—from disk compression to ontivirus protection.

Bookstores are alreody stocking telephone-book-size DOS 6.0 compendiums, but Fostrox asks only on hour of your time, and it's interoctive. It's the best way to master DOS 6.0 quickly.

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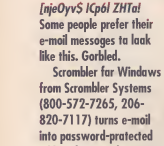
Intelligent Buyer's Assurance Seal was awarded to the Epson EPL-4000 on September 14, 1992. PC World's "Best Buy" was awarded to the Epson ActionLaser II in April, 1992 and the EPL-7500 in December, 1991. All company and/or product names are trademarks and/or registered trademarks of their respective manufacturers. Epson is a registered trademark of Seiko Epson Corp. ©1993 Epson America Inc. 2780 Madrona Ave., Torrance, CA 90505. For dealer referral, call 800-BUY-EPSON (800-289-3776). In Canada, call 800-GO-EPSON. For Latin America, 805-565-0292.

HP's 100LX Palmtop: It's Not Just For Spreadsheets Anymore

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With the exception of Lotus Notes, Scrombler supports most popular e-mail applications, and it can also be set up to scromble popular spreadsheet and word processor file formots. With mare legal battles erupting aver e-mail privacy, Scrambler is worth its weight in legal bills.

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(503) 757-2004

HEWLETT-PACKARD'S 95LX, the first PC to travel in a jacket pocket, has spawned a much more powerful, business-class cousin. The new HP 100LX adds Lotus's cc:Mail Remote e-mail package to the palmtop's suite of applications, as well as upgrades to existing software—and a faster CPU. Moreover, it's the most intriguing glimpse we've seen of the wireless technology that will soon flood the market.

At the heart of the $749 100LX is Intel's 7.9MHz 80C186 CPU, which processes code up to 50 percent faster than the 5.4MHz V20-based 95LX. Performance differences between the two palmtops were palpable in our tests, especially in spreadsheet recalculations. Let's not kid ourselves, however: No one pecks out elaborate financial models on the 100LX's calculator-size QWERTY keyboard. Also, while the nonilluminated CGA display is an improvement over the MDA display on the 95LX, its 5¹/₈-inch size will make you squint.

Still, Lotus 1-2-3 Release 2.4 is built into ROM, as are DOS 5.0 and a clipboard feature that lets you shuttle data between applications. The appointment book has been revamped to include week- and month-at-a-glance calendars as well as to-do lists that carry over to the next day. The personal information manager is easier to use than in the previous version, aided by a three-level zoom feature.

Recognizing that the 100LX's future is communications, Hewlett-Packard furnished the machine with a rich array of both wireless and cabled capabilities for staying in touch. cc:Mail Remote works in both interactive and batch modes via the upgraded nine-pin serial port. An infrared link (capable of transferring data at 115K per second) comes standard. Later this year HP plans to introduce a line of Vectra desktop PCs with a built-in infrared port, which will allow you to synchronize files between palmtop and desktop PCs in Star Trek–like fashion by beaming information between PCs (or between palmtop and printer).

Meanwhile, the 100LX works with Ericsson GE's wireless radio modem in conjunction with the RAM Mobile Data network. An optional connectivity pack provides bidirectional file transfer via the serial port. A simpler—though pricier—solution to file transfers is offered through optional 5MB ($499) or 10MB ($879) PCMCIA Version 2 flash cards.

Even without a flash card, the 100LX comes with 2MB of ROM for DOS and the system's applications, including a filer, a note taker, a phone book, HP's financial calculator (which works in conjunction with 1-2-3), and other utilities, in addition to those already mentioned. Like the 95LX, the 100LX features a full megabyte of RAM and features a 3-volt lithium back-up battery to prevent you from losing data if the regular batteries die. Unlike the 95LX, the 100LX can run off rechargeable nickel-metal hydride or standard AA batteries.

At 6.3 by 3.4 by 1 inches and weighing a mere 11 ounces—including batteries—the 100LX provides as much computing power as you can fit in your pocket.

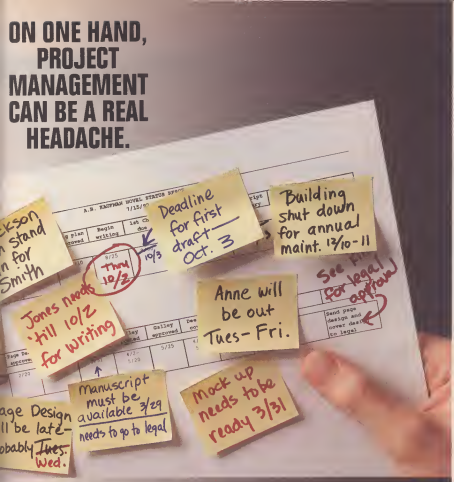
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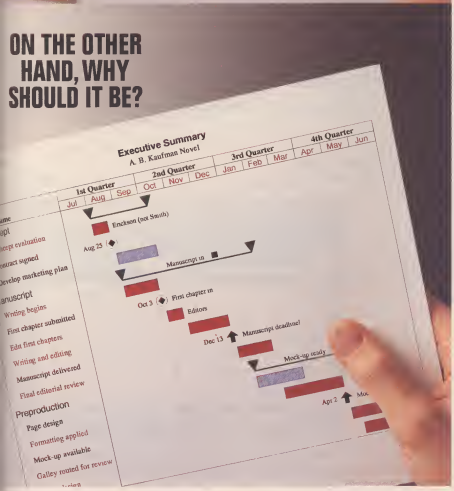
Applications are represented by icons.



A "dashboard" lets you switch applications.

HP's 100LX Palmtop PC offers a built-in infrared port as well as optional links to radio modems and pagers.







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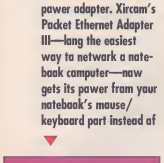
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WinSense Isn't a Perfect Advisor, But It's a Worthy Windows Snoop

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Simply plug the ethernet adapter into the notebook's parallel port, and then attach one end of the included Phantom Power Cable to your notebook's mouse/keyboard port and the other end to the ethernet adapter. A pass-through feature keeps mice and external keyboards connected to your notebook.

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CURIOSITY NOT ONLY killed the cat, but it also has crashed many PCs running Windows. Out of curiosity, you examine Windows INI configuration files, make a few seemingly innocent changes, and before long, *kaboom*.

As its name implies, WinSense 1.2 from SoftLogic Solutions makes sense out of the baffling array of settings in Windows configuration files. WinSense enables even the most curious and experiment-prone users to intelligently tweak Windows for maximum performance.

When you install it, WinSense analyzes your system. Then you fill out a brief profile of the chores you perform with your computer. WinSense uses this information to make recommendations about how to optimize Windows for your needs.

WinSense's greatest asset is its flexibility, which enables you to approach Windows optimization from many directions. For example, you can enhance performance, or you can tweak Windows' appearance. You can focus on memory management, or you can optimize Windows for networks. WinSense can give you a series of recommendations, or it can take you through the relevant sections of your INI files one line at a time. WinSense's impressive information files provide a clear, complete explanation about each line, as well as the benefits and risks of changing it.

Besides suggesting changes, WinSense recommends that you delete irrelevant settings—such as network settings on PCs that are not connected to a network. When you are done, WinSense implements the changes, which take effect the next time you start Windows. This process sped up the time it took us to load Windows by about 10 percent.

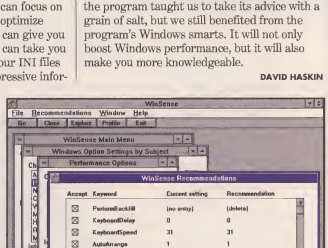
After using WinSense on our 486/33, we especially noticed improvements in video refresh speed and keyboard responsiveness. In Word for Windows, for example, characters registered very fast. In fact, features that optimize and customize your keyboard (see the screen below) are big pluses in WinSense.

We encountered only a couple of small problems during our evaluation. When WinSense provides a list of recommendations, you can either accept or reject each one. However, don't expect to insert your own option unless you use WinSense's one-setting-at-a-time approach. WinSense also misread the size of our SmartDrive cache.

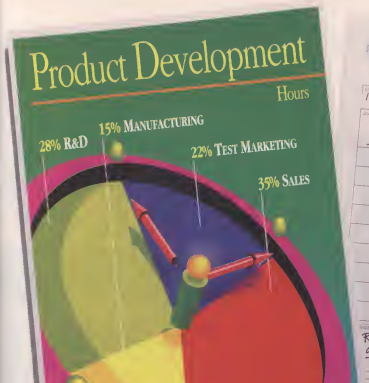
Another word of caution: Some Windows-enhancement utilities change your Windows configuration files, and if you don't remember those changes, you might inadvertently undo them by following WinSense's recommendations. For example, WinSense found that we had switched Print Manager off and suggested that we switch it on—which would have hurt the performance of our printer-enhancement utility. Remember that WinSense's advice is just that—advice.

WinSense is a must for both performance nuts and curiosity freaks. Our experience with the program taught us to take its advice with a grain of salt, but we still benefited from the program's Windows smarts. It will not only boost Windows performance, but it will also make you more knowledgeable.

DAVID HASKIN



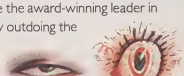
WinSense analyzes Windows INI configuration files and makes recommendations for settings such as keyboard responsiveness.





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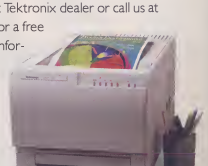


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We'd hate to brag. So we'll let the PC press do it for us.

Both *PC Magazine* and *Publish* called the HP ScanJet IIc the *Best Color Scanner* for 1992. While *PC Computing* named the black & white/gray-scale HP ScanJet IIp the *Most Valuable Product* of the year.

Speed. Simplicity. And accuracy were all applauded. It's no wonder. HP's single-pass scanning delivers both lightning-fast speed and precise color registration. TWAIN support allows scanning without having to switch between applications. And HP AccuPage technology with 400-dpi resolution can tackle the toughest OCR challenges. What's more, capabilities this advanced are now even more affordable. List price on the HP ScanJet IIc has just dropped to $1,599. The HP ScanJet IIp is just $879.

Impressed? Don't just take our word for it, or even the PC press's. Attend one of our scanning seminars that will be held April through September, 1993. To find out more about the HP ScanJet IIc and IIp or seminars in your area, call 1-800-SCANJET, Ext. 7365.* And judge for yourself.

HEWLETT PACKARD

DEEP-SIX YOUR JUNK FAXES

If only mailboxes were this smart. DataFax, a $129 Windows fax program from Tria (800-880-4400, 919-846-4990), equips your fax modem with a trap door for junk faxes. Just list



junk fax purveyors, and it refuses faxes from those machines again.

Like other fax programs, such as Delrina's WinFax Pro, DataFax has OCR for converting incoming faxes from image files to editable text files. But it also combines this with text retrieval. DataFax automatically indexes text in faxes and searches through the contents.

DataFax lets you mark a block of text and fax it directly from your application. The best feature: The program can automatically forward incoming faxes, a boon for travelers who want faxes sent to their destination. **DAVID HASKIN**

Cheap Compaq ProLinea 486/66 Systems Board the Local Bus

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ALMOST SINGLE-handedly, Compaq's 486 ProLinea systems provoked the PC price wars and killed the 386. And the prices are getting even lower. Launching yet another attack on 486 pricing, Compaq's newest ProLineas are wrapped around a speedy 66MHz 486DX2 processor and high-resolution local-bus video—yet wear price tags as low as $1,999. You can find a faster competitor in Gateway's MVP-winning VESA local-bus 4DX2-66V (see New!, December 1992, page 44), but the trim and sleek ProLineas are the cheapest choices if you don't need any frills. From design to performance, the new ProLineas are built to impress.

Incorporating the signature design that housed the 33MHz 486 ProLinea, the new 66MHz 486DX2 models pack a 120MB, 240MB, or 340MB hard drive; 5¼- and 3½-inch floppy drives; and 4MB of RAM (expandable to 32MB) into a graceful slimline case. Opening the case reveals a solid, if limited, design that accommodates three side-mounted 16-bit expansion slots. In addition, a full complement of keyboard, mouse, parallel, and serial ports are integrated onto the motherboard.

Also on the motherboard is a proprietary local-bus video design that uses the new ET4000/W32 chip from Tseng Labs. The ET4000/W32 isn't as snappy as the Mach 32 chip in the ATI Graphics Ultra Pro found in Gateway 2000's local-bus systems or the astonishingly spry Weitek Power 9000 graphics chip Zeos uses in its local-bus 486DX2/66, but it's still two to four times faster than standard VGA on the ISA bus. Performance on the Model 240 we tested was slightly slower than on Gateway's 66MHz system, and the Gateway also comes with much more storage.

Limited Expansion

Expansion options are limited on the ProLineas; there's no processor upgrade socket, and the SIMMs are awkwardly tucked under the hard drive (you have to remove the hard drive to install more memory). There are also no local-bus slots for adding local-bus peripherals down the road (the Zeos and Gateway 486DX2/66 systems offer VESA local-bus expansion slots and put both the disk controller and video on the local bus). Even so, the Compaq systems are quiet, trim, and solidly built—perfect for hanging off a network. The 66MHz 486DX2 processor also ensures there's enough horsepower to satisfy even the most power-hungry Windows users.

Cheap Solutions

Compaq no longer provides list prices for its systems, but expect to see the 120MB version on the street for a competitive $1,999 (add $200 to $300 for models with larger hard drives). These prices don't include the monitor—plan to pay an additional $450 for the 14-inch version and $550 for the 15-inch display with a flat-square screen and digital controls. Gateway's faster $2,995 system includes 8MB of RAM, a 340MB hard drive, and a 15-inch monitor, making it a better buy if you need extras.

All of Compaq's systems come with a three-year warranty (the first year includes free onsite service) and 24-hour tech support seven days a week. You can buy a slightly faster, more expandable local-bus 66MHz system from Gateway, but if you don't need perks such as extra storage, Compaq's local-bus ProLineas are the cheapest deal going.

WENDY TAYLOR



Compaq's new 486DX2/66 ProLineas offer local-bus video and fast performance—at rock-bottom prices.

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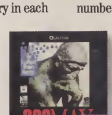
That's because new 386MAX is so well integrated with the workings of DOS, you actually get better, more flexible DOS under Windows than with DOS alone. Including up to 736K of conventional memory in each DOS session thanks to our powerful new Windows features. That's 100K more than you'll get even with the improved memory management built into new DOS 6. Plus, new 386MAX makes it easy to get top performance from each DOS application in Windows by guiding you effortlessly to the optimum configuration for your system.

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System requirements. Any 386, 486, or Pentium micro-processor based PC or PS/2, min. 256KB of extended memory, DOS 3.3 or higher, high density floppy disk or hard disk drive.

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PACKRAT 5.0 FROM Polaris Software is unlike any Windows information manager you've ever seen. It bears a resemblance to its predecessor—PackRat 4.1—in name only.

The product is different right from the get-go. When you start the program, a slick SmartStart feature asks questions about your profession to determine how you work and then builds a default set of folders and objects. Instead of presenting predefined screens as personal information managers such as Desktop Set and Organizer do, PackRat lets you design your own work space. Each work space uses whatever organizational method suits your work habits. You can have different folders available at the same time—organized by project, task, or any other scheme.

PackRat's objects, represented by icons, are items you place on a folder. You get a large selection of preconfigured objects, including an appointment list, a calendar, a task list, financial-tracking lists, and contact lists. To use one of these objects, you pluck it from a dialog box and place it anywhere on the folder.

You can then size and move each object and even alter its form. You can change which fields are displayed or need to be filled out. When designing a phone book, for example, you may want each entry form to list just name, city, and phone number. With a few clicks of the mouse, only these fields appear on your list. In a networked environment, one common set of data is entered on the form, although each person can customize the view in minutes with the mouse.

Do you have other applications—a word processor or spreadsheet—that you use with certain projects? No problem. PackRat 5.0 lets you place application icons or miniwindows on any folder. Thus, folders become one-stop desktops not only for personal information management, but also for other applications.

PackRat can be as simple as a Volkswagen or as complex as a Ferrari. If you just want a basic application, PackRat's context-sensitive pop-up menus and simple folders and objects make organizing your information nearly effortless. In addition, PackRat doesn't stick you with icons and actions you never use. You can place icon bars, called *action bars,* on some objects and not on others, and you can customize icons.

If you want to make PackRat a Ferrari, simplicity gives way to more options. You can create or rearrange your own set of action buttons, customize certain forms so that they're specific to your business, or, better still, use the PackRatBasic macro language to create and build entire application scripts. In addition, the soon-to-be-released network version integrates your current e-mail package with PackRat's scheduling and group-tracking features.

So what are the drawbacks? We wish some of the objects were more flexible. For example, the day viewer shows either tasks or appointments but not both. Also, certain fields and objects are not directly editable—you have to open a form to make changes.

Still, PackRat 5.0 is an up-to-snuff application builder that's visual, flexible, and object driven. Best of all, it lets you do your work the way *you* want to do it.

MICHAEL BURGARD

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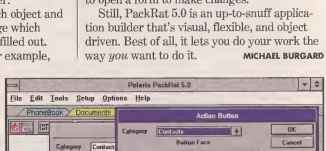
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WENDY TAYLOR



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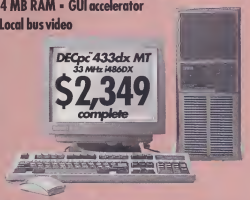
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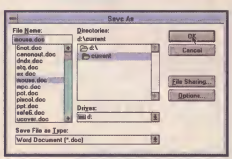
Microsoft's Overhauled Mouse: Smarter Software, More Comfort

BETTER SOFTWARE
The top screen seen here shows the Microsoft Mouse software utility's outstanding new Snap-to feature. When the Snap-to option is selected, the mouse cursor automatically locates the default



choices in dialog boxes and menus. As seen in the bottom screen, the cursor has automatically moved to the default "OK" button in a Word for Windows dialog box.

This is just one of many improvements in the mouse utility software. Another of our favorite features was a Screen Wrap option: Just move your cursor to any edge of the screen, and it will reappear at the opposite edge.



MICROSOFT MOUSE, BUS VERSION, $125, SERIAL PS/2 VERSIONS, $109; MICROSOFT CORP., ONE MICROSOFT WAY, REDMOND, WA 98052, (800) 426-9400

MICROSOFT'S NEWLY redesigned mouse looks as if it just swallowed a canary, judging by the bulge in the middle of its asymmetrical body. Are the physical modifications just fluff? No. The new mouse's odd shape tracks the contours of both left and right hands, letting you point and click with unprecedented comfort. Even better, the accompanying software is chock-full of enhancements that make Windows a lot friendlier.

Like the old version, the new mouse has two buttons, with the left one slightly larger. New are finger-size depressions on each button and a slight ridge separating the two. As with the new shape, this design touch means a smoother fit with the hand—although the two-button design (as opposed to Logitech's three-button design) does make Microsoft's mouse less versatile for those who crave variety in mouse/keyboard combinations.

As physically appealing as the new mouse is, it's the accompanying software that distinguishes it from the rest of the litter. You can modify cursor speed and size—small, medium, or large. You can also magnify parts of the screen and snap cursors immediately to the center of your screen.

The best new software feature, though, is the Mouse Manager, which gives you both Snap-to and Screen Wrap to enhance your use of the mouse and to improve the point-and-click process. With Snap-to, the cursor locates the default choice of any dialog box. For instance, if a general protection fault occurs, your mouse cursor automatically snaps to the Close option. This saves you from having to drag your cursor around the screen, and it's a great usability enhancement to Windows—especially for notebook users.

With Screen Wrap, as you move the cursor off any edge of the screen, it reappears at the opposite edge. If you're in the lower right corner of your screen scrolling through some e-mail and you want to go to the upper left corner, just move your cursor a smidgen to the right and down until it hits an edge of the screen. The cursor automatically appears again at the upper left corner of your screen. This saves time and motion, although it also takes getting used to. Anyone accustomed to bouncing the cursor off the screen's borders will need to adjust, but Screen Wrap soon earns its stripes as a little utility that improves computing in a big way.

One conspicuous drawback of the new Mouse Manager is its inability to tie system functions and commands to the inactive mouse button, which has been a feature of third-party mouse utility software for some time.

The new Microsoft Mouse may not be the true *Volksmaus*, but varied preferences and aesthetic sensibilities make the creation of a one-size-fits-all pointing device impossible. Many users will prefer Logitech's MouseMan, which comes with an extra button and is available in versions for right and left hands. However, the mouse utility software is what really makes Microsoft's new rodent worth owning. Registered users of the old Microsoft Mouse can buy the new software directly from Microsoft for $19.95.

Our advice: If you use other mouse utility software: Check out Microsoft's.

CHARLES BERMANT



The new Microsoft Mouse's improved ergonomic design beats the old, nondescript version (bottom).



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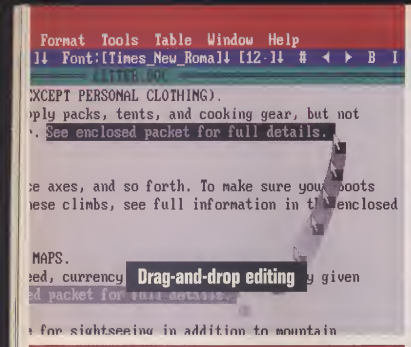
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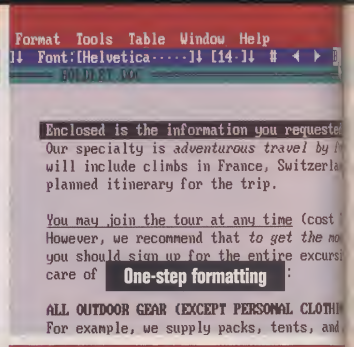
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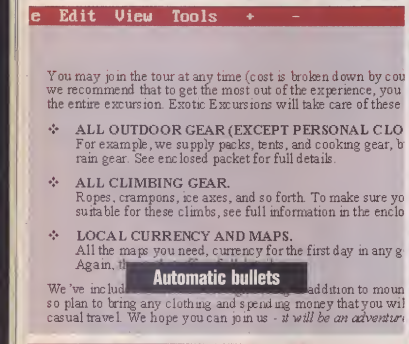
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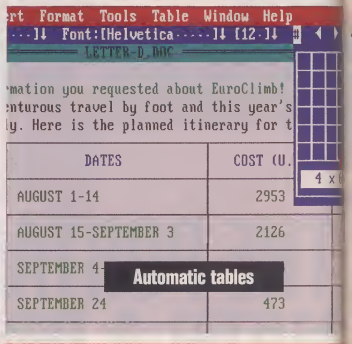
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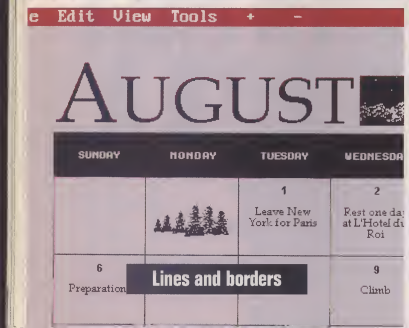
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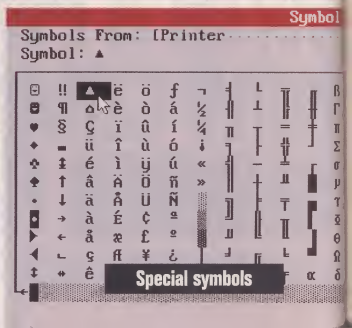

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SOONER OR LATER, data gets backed up or it gets lost. Iomega's Bernoulli removable disk drives stand out if you're going to carry your backups anywhere. Bernoulli drives have been around for over a decade, the cartridges are virtually indestructible, and now you get increased cartridge capacity. Iomega's latest Bernoulli drive, the MultiDisk 150, packs a whopping 150MB of data on a slender 5½-inch-square lightweight Bernoulli cartridge.

The MultiDisk drives mark the first time Iomega has offered a range of cartridge capacities. Besides the 150MB version, you can also buy 35MB, 65MB, and 105MB cartridges for the drive. There's also an array of drive models. We tested the PC Powered version, an unconventionally designed external unit that comes with an 8-bit SCSI interface card.

Performance for the drive was impressive. With an average access speed of about 17 milliseconds in our tests, the MultiDisk 150 is comparable to conventional hard drives. And even with the standard 8-bit interface board, data transfer is fast.

The MultiDisk 150 comes with a single 150MB cartridge that's crammed with 150MB of shareware, as well as a copy of Central Point Backup. If you send in your registration card, you also get a free copy of Stacker disk-compression software, which doubles the cartridge capacity.

There's just one drawback: Iomega drives remain pricey. The PC Powered model lists for $1,122, and 150MB cartridges list for a whopping $245 each (you can get a better deal by buying a Five-Pack for a list price of $799). Lower-capacity cartridges start at $79 for the 35MB versions.

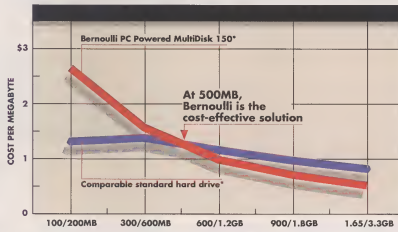
You won't want to buy a MultiDisk just for a little more storage capacity—the prices are too high—but if you're looking for a convenient way to back up lots of data and then transport it, this is it.

STAN MIASTKOWSKI



Iomega's MultiDisk Bernoulli drives offer capacities from 35MB to 150MB on a 5¼-inch cartridge.

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NATHAN GARCIA

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* Ziff-Davis WinMark 3.1, 486 DX 2/66, 4Mb memory, 1024 x 768 in 256 colors, 72 Hz.

NETWORKING

LANtastic 5.0 Reaches Higher With Client/Server Features

LANTASTIC 5.0. (NWO. STATIONS, $659. WITH WINDOWS SHELL, $759. ARTISOFT, 691 E. RIVER RD, TUCSON, AZ 85704, (800) 846-9726.

LANTASTIC HAS always been the Rodney Dangerfield of the networking world, seldom getting much respect from the high priests of client-server–based LANs. Not so, however, among small businesses and corporate departments, which have long recognized the advantages of low-cost-but-capable peer-to-peer connectivity. With the release of LANtastic 5.0, Artisoft casts its net a little wider to encompass the would-be clients of high-end LANs.

Small-network users aren't greatly affected—sure, there's a raft of neat new bells and whistles. But LANtastic 5.0's most significant improvements are aimed squarely at large installations. LANtastic 5.0 now supports up to 500 users, instead of the previous limit of 300. And, yes, NetWare connectivity is finally built in. In fact, by designating a LANtastic node as a NetWare client, you can give everyone on your LANtastic network access to NetWare servers. You can bridge to Unix NFS networks in the same way, and a new NetBIOS lets you interconnect different types of network media—via ARCnet, ethernet, or even serial ports—into a single network.

Of course, all these new connections require security, and LANtastic 5.0 delivers that in spades while at the same time easing headaches for system administrators. A LANtastic 5.0 network administrator can set up accounts and access rights for all users on all servers from any node, giving users transparent access to all network resources regardless of where they are located. The user-access hierarchy has been extended to the file level, and different levels of access can be assigned to groups as well as individuals.

LANtastic/AI is a shell option that runs on top of the DOS-based network operating system. Its Scrapbook feature works almost exactly like the ClipBook in Microsoft's Windows for Workgroups, creating a database of clipboard images that can be accessed and shared across the network.

Another notable feature is LAN Radio, which works much like a trucker's CB radio. If each LANtastic user has Artisoft's Sounding Board add-in card with a built-in telephone handset, you can set up multiple two-or-more-way voice conversations on any of 100 channels. There's no easy way to "ring" other users, but you can use chat mode, mail, or your telephone to set up these conference calls.

LANtastic 5.0's only shortcomings are its wimpy e-mail facilities and lack of group-scheduling abilities. These are areas where Microsoft's Windows for Workgroups outdoes LANtastic. Also, there are plenty of third-party solutions to those problems—such as Campbell Services' OnTime for Windows/DOS, and Microsoft Schedule Plus. Pricing is also a bit confusing, depending on whether you're purchasing Artisoft's own network cards or just the software that runs on industry-standard cards. Still, the bottom line for the software is surprisingly inexpensive—about $7 per node for 500 users.

LANtastic 5.0 can easily be integrated into an existing enterprise, and its new client-server focus is a significant step forward. Especially for existing LANtastic users, new features such as NetWare support are must-haves.

STAN MIASTKOWSKI

CHEAP VIDEO EDITING

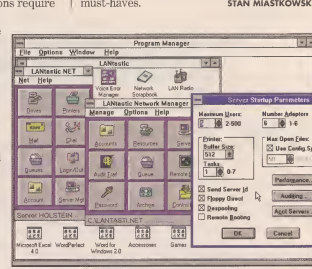
VideoDirector from Gold Disk (800-465-3375, 800-835-5889 in California) converts a PC into a credible, if limited, video-editing system. You can use the $199.95 VideoDirector to simply control the transfer of the analog video between a camcorder and a



VCR (or between two VCR decks). The program retains information about each tape's contents in a database. You connect your PC to the video equipment by attaching an included SmartCable to your serial port.

VideoDirector has one shortcoming: It only handles assembly edits—once you assemble the video clips, you can't add transition effects. Still, if you want to arrange video clips into a clean master tape, this is the most cost-effective solution.

JON PEPPER



LANtastic 5.0 allows system administrators to set up accounts and access rights for all users on all servers from any node.

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WinFax PRO 2.0 made it easy to send and receive faxes, winning *PC Magazine's* prestigious *Best of 1991* award in the process. But we didn't stop there. New WinFax PRO 3.0 changes the face of PC faxing once again, putting a full spectrum of powerful tools at your fingertips.

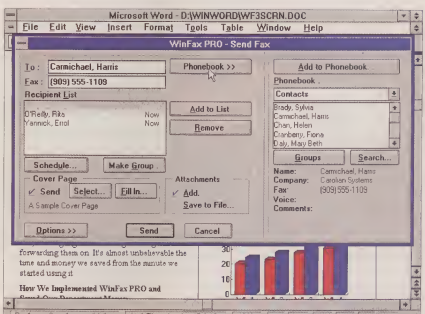
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AMC

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UNLESS YOU'RE RUNNING THE DATABASE.



Nikki Driver
Sports Director, Utah Winter Games

ANNOUNCING DATAPERFECT® 2.3. Athletes at the Utah Winter Games compete in twenty-one different events, including speed skating, downhill skiing, snowmobile racing and ice hockey. This year, officials at the Games used DataPerfect to organize information on events and participants. "We needed a powerful database application that was quick to learn and comparatively easy to use," according to Nikki Driver, sports director at the Games. "None of us is what you'd call a computer expert. We'd rather spend our time concentrating on the events instead of figuring out a complicated database program. DataPerfect was ideal for us." It just may be ideal for you, too.

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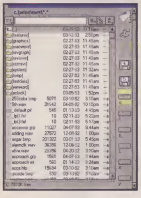
Call us at 800-526-9883, and we'll send you the DataPerfect 2.3 Test Drive Kit – a complete working demo – at no charge. Find out for yourself how easy it is to use DataPerfect 2.3. If you're like most, your work is complicated. Your database application shouldn't be.

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WordPerfect®

SMART FOLDERS FOR WINDOWS

SideBar 2.0 from Poper Software (800-551-5187, 914-255-0056) is oimed to end Macintosh envy. It's a Windows desktop manager that enables you to store files ond applications as icans within folders—as you can on the Mac. You can



organize these folders by function: A single folder can hold all applications, onother all files relating to a specific document, and so on. You can customize the program ta route certain files autamatically to certain folders.

SideBor ($59; through October, $39.99) isn't as ombitious as Norton Desktop or PC Tools for Windows, but it's an el-egont organizational tool. BRUCE SCHNEIER

Altec's Audio Controller Mixes Sound, Centralizes Audio Cabling

ALTEC LANSING AC10 AUDIO CONTROLLER, $250
ALTEC LANSING
P.O. BOX 277
MILFORD, PA 18337-0277
(800) 548-0620

THE TANGLE OF WIRES and connectors leading to and from most multimedia PCs can be vexing. Altec Lansing's AC10 audio controller acts as a central controller station for managing audio input from devices that feed audio data in and out of a multimedia system.

The AC10 audio controller consists of two components—the system hub and a hand-held control unit. The hub has plugs for three stereo inputs and two stereo outputs. Connect a sound card, CD-ROM drive, laserdisc, and two speakers into the AC10, and you can individually switch each of the input sources on or off. The combined signal is routed to both output ports, and the hand-held controller adjusts volume, bass, treble, and balance.

A built-in microphone serves as a mouthpiece when you're using the AC10 as a speaker phone. To avoid feedback from the speakers, the microphone signal is not mixed into the combined audio output; it feeds out of a separate port on the system hub.

The $250 AC10 needs one thing: It should let you adjust the volume of the various inputs independently. Nonetheless, it's the only product that easily controls a number of multimedia audio devices, and we recommend it if you're experiencing audio-cable overload.

JEFF GREENBERG



Altec Lonsing's AC10 oudia cantral manoges multiple oudio input devices to your PC at once.

Microsoft Mail Remote: Dialing for E-Mail

MICROSOFT MAIL REMOTE FOR WINDOWS 3.2, 20 USERS, $2,749
MICROSOFT CORP.
ONE MICROSOFT WAY
REDMOND, WA 98052
(800) 426-9400

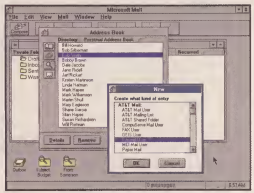
MICROSOFT MAIL HAS always had a big limitation: It offered no remote access. Now, Microsoft Mail users can get easy worldwide access to e-mail with Microsoft Mail Remote for Windows 3.2.

Remote for Windows lets you connect to a LAN-based Microsoft Mail 3.*x* e-mail system either locally or remotely—over a phone line. It's the perfect companion for a notebook computer. In addition to offering Microsoft Mail access, the Remote package serves as a front-end for AT&T's Mail service.

You can choose either an event-driven connection (such as at startup or at program exit) or a time-driven connection (such as at 3 p.m. every day). The program worked flawlessly in our tests.

A 20-user version of Remote for Windows is $2,749, and the Microsoft Mail 3.2 Remote client is $195 per user. For traveling Mail users, this product is big connectivity news.

DALE LEWALLEN



Microsoft Mail Remote lets you send messoges vio MCI Moil, fox, CompuServe, and paper mail.



Luring new business.

Charles McGuire, food production consultant in Boise, uses ScanMan 256 with OCR to put text and images into a professional-looking newsletter on fish farming. Now he's reeling in clients.



Had the drive, but not the green.

Chris Maxwell of Idaho didn't have the cash to launch his magazine, "Inland Empire Golfer", until ScanMan Color gave him high-quality color images without the hazards of costly service bureaus.



Make a big impression.

Peakdesign of Oakland uses Logitech's ScanMan to create customized icons for user-friendly interfaces on proprietary systems. The end product looks tailor made, and the clients look impressed.



Stuck for time.

If you don't want to spend countless hours trying to copy an image freehand, follow the lead of Computot, a Massachusetts company that uses ScanMan Color to scan images into a computer-aided tattoo design system. (No kidding.)



The easy way.

If you find yourself in need of some quick cash, the U.S. Treasury Department would like you to know this is quite illegal.

Seven ways to Profit WITH ScanMan (six proven, one prohibited)

Any one of our hand-held scanners can do anything a flatbed can do and more, at about a third of the price. See your local dealer, or CALL 1-800-732-3096





Don't lose your punch.

Researcher Debbie McKoy retyped so many documents, she wore out three keyboards. So she bought ScanMan with OCR. Now she's not only saving keyboard wear, but her fingers and time as well.



Earth-shaking effects.

When he wants to add large maps and charts to the textbook he's writing, California geophysicist Rick Blakely uses Logitech's ScanMan with AutoStitch to lace together individual scans. It makes his data more moving.

Circle 177 on reader service card.

LOGITECH

The Senseware™ Company

ScanMan® Color. 16.8 million colors and FotoTouch™ Color software. ScanMan 256: FotoTouch, 256 grayscale, and Catchword Pro™ OCR ScanMan 32: FotoTouch, 32 grayscale, and Catchword OCR ™ ® Trademarks belong to their registered owners. GSA approved

Spotlight

Multimedia PCs

Multimedia computing isn't just for home-based fans of new gadgetry anymore. One benefit of falling PC prices is that name-brand manufacturers are trotting out full-powered business platforms—as opposed to the gutless 386SX machines characteristic of the first age of multimedia.

Compaq Computer now has the 486SX/25-equipped **ProLinea CDS** with a MediaVision Pro Audio Spectrum 16 sound board, a microphone, speakers, a CD-ROM drive, and $500 warth of CD-ROM titles. You also get a 14-inch Super VGA manitar, local-bus graphics, a fax modem, and DOS 6.0, Windows 3.1, and PFS:WindowWarks 2.0 preloadded an its 120MB hard drive. ($1,999; Compaq Computer Carp.; 800-345-1518)

Dell Computer sells a comparable machine at the same price. The base model **ValueStation 486** has the same processar, memary, and hard drive as the ProLinea, with similar multimedia hardware and software. But you can chaase amang four ather hard drive sizes and three ather processars, ar build your awn machine with parts from the DellWare catalag. ($1,999; Dell Computer; 800-289-3355)

ALR's **Evolution IV MPC** casts a bit mare but includes a 486DX/33 pracessar, a 170MB drive, six drive bays, and six ISA slats including an empty 32-bit local-bus slat. The system combines a saund card, a micraphane, a built-in speaker, and a CD-ROM player with a cael disk bundle. If yau want a 486DX2/66 ar a 340MB IDE drive, it'll cast you mare. ($2,697; ALR; 800-444-4257)

THE LATEST UPGRADES TO PRODUCTS YOU USE

BY MIKE HOGAN

WordPerfect 5.2 for Windows

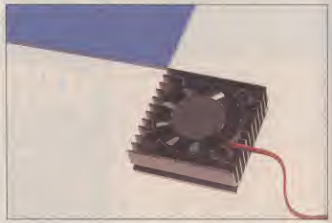
An interim release of WordPerfect 5.2 for Windows includes a new utility, KickOff, for launching any Windows program or any DOS program running under Windows. KickOff lets WordPerfect users update QuickFinder indexes, but it can also be used for other applications such as downloading data from a bulletin board system at night, when rates are cheaper. The improved File Open dialog box lets you create and delete directories, and select multiple files to open, move, rename, or delete. It also provides support for linking to Quattro Pro for Windows' WB1 format and fixes some problems with handling graphics. This release is available to registered users for $24.95. (WordPerfect Corp.; 800-321-4566)

Lotus Notes Release 3.0 and Starter Pack

Integration with other Lotus products and the ability for Notes users to communicate across operating systems highlight Release 3.0 of this client-server development environment. Lotus's Version Manager enables users to intelligently manage, merge, and share versions of 1-2-3 for Windows spreadsheets. A new Notes Starter Pack lets work groups as small as ten people set up a Notes environment for as little as $100 per user (see full review in the May issue, page 48). ($995; Lotus Corp.; 800-828-7086)

Stacker 3.1

This version of the popular disk compressor seamlessly integrates itself into Microsoft's new DOS 6.0, reducing installation time from DOS or Windows and letting all DOS commands work directly on Stacker drives. Stac Electronics claims that Stacker 3.1 provides at least 10 percent greater compression (without any decompression speed loss) than the DoubleSpace utility that's bundled with DOS 6.0; Stacker also includes disk-optimization features. ($149, $19.95 to upgrade; Stac Electronics; 619-431-7474)



Does your 486DX PC ever shut down, sending your doto and/or hord drive directory to digitol hell? It con hoppen if you overwork a 486DX2 or Pentium processor in a less-thon-frigid environment. CPU Kooler is a heot-sink/minifon thot odheres to your 486 like a top hot (or onto the top hot olready on a Pentium PC). When plugged into a spore floppy-drive power source, CPU Kooler lowers your CPU's temperature to an acceptable 15 degrees above your cabinet's ambient temperature. Cool. ($39.95; PCubid; 916-338-1338)

AST Premmia

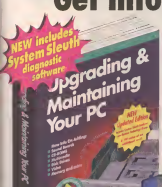
This family of systems includes local-bus video, a hardware cursor, and 1MB of DRAM, all of which combine to speed up Windows performance 200 percent over that of the Power Premium line that the Premmias replace. Upgradable with Intel's OverDrive or Pentium processors, the Premmias also feature flash BIOS and accept modules for cache, ethernet, or other upgrades. The floppy-drive-only Model 3 with a 33MHz 486DX is $2,095. (AST Research; 800-876-4278, 714-727-4141)

Professor DOS 6.0

This complete DOS tutorial emphasizes the new features in Micrososft's DOS 6.0 and describes how to use its new disk-compression, antivirus, and disk-caching utilities. You also learn 6.0's powerful new commands. ($49.95; Individual Software; 800-822-3522)

We Deliver Computing Know How

Get Into the Action with Books from Abacus



Upgrading & Maintaining Your PC

Turn your PC into a high performance screamer. Whether you're adding memory or a hard drive, CD-ROM or a sound board or upgrading an XT to a 386 or 486, this book shows you how. Includes companion diskette of utilities and System Sleuth™ diagnostic software. 598 pages.

#B167. ISBN 1-55755-167-7. Suggested retail price $34.95.



Wicked Sounds

This outrageous book/disk lets you sit back and have some fun with Windows' built in sound capabilities. "Sound off" by attaching a sound to any of 12 different Windows events; closing a window, etc. Includes Sound DATA BASE manager to organize and identify your growing library of wave forms.

#B168. ISBN 1-55755-168-5. Price $29.95 with companion disk including wave forms and Sound Database Manager.



OS/2 BIBLE

Explains the many features and tools that are part of the OS/2 32-bit multitasking system, its special functions and the utilities that are part of the package. Whether you want to link simple DOS applications, run Windows programs under the Workplace Shell or understand the structure of OS/2 2.1, this book covers all of these topics.

#B174. ISBN 1-55755-174-X. $34.95 with companion disk.



DOS 6.0 • Special Edition

is *the* practical user's guide to DOS 6.0. This book is loaded with helpful hints for outfitting any computer with the new MS-DOS 6.0, covering everything from installation to using the new file, directory and storage maintenance features.

DOS 6.0 Complete includes a companion disk with dozens of powerful batch files, detailed explanations and **Tempest** - the new graphic shell for DOS 6.0. 1100 pages.

#B182. ISBN 1-55755-182-0. Price $39.95 with companion disk.



Sound Blaster Book

Newly revised, this book is your guide to **Sound Blaster**, from installation to custom programming. Includes an overview of the different **Sound Blaster** cards, many specific software products and much more. Also includes simple MIDI system to use with your **Sound Blaster**.

#B181. ISBN 1-55755-181-2. Price $34.95 with 3.5" companion disk.



Pilot's Shop

Flight Simulator's Pilot Shop teaches student pilots to fly Flight Simulator. You'll learn the basics of taxiing and takeoffs, climbs and turns, traffic patterns and landings. Includes companion diskette with new scenery, planes (requires ASD). Large section details the *Whale Earth Catalog* of add-ons for Flight Simulator.

#B179. ISBN 1-55755-179-0. Price $29.95 with 3.5" companion diskette.



The 486 Book

Explains the features that make this processor so advantageous - the memory capabilities, the math coprocessor, the specialized software that maximizes the CPU's performance and more. PC INFO program and System Sleuth™ diagnostic software on companion diskette.

#B183. ISBN 1-55755-183-9. Price $34.95 with 3.5" companion diskette. 420 pages.



Multimedia Mania

This book removes the hype surrounding multimedia. Learn the basics from adding CD-ROMs and sound boards to making a MPC system. Includes CD-ROM with over 400 megabytes of sounds, graphics, animations, samples and techniques to get you deep into the world of multimedia. Also includes several commercial multimedia demonstrations

#B166. ISBN 1-55755-166-9. $49.95 with companion CD-ROM.

Circle 138 on reader service card.

Order Toll Free 1-800-451-4319

Available at B. Dalton, Crown Books, Egghead, Software Etc.,Waldenbooks, Computer City and other retailers nationwide. In Canada, Coles W.H. Smith and Classic Bookshops.
In the UK, call Computer Bookshops 021-706-1188.
In Australia call Pactronics 02-748-4700.

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____	DOS 6.0 SE	$39.95 ea.
____	Sound Blaster Book	$34.95 ea.
____	Pilot's Shop	$29.95 ea.
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New!

BEST BETS

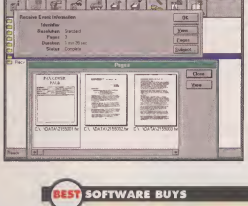
TOP DEALS FOR YOUR PC

BY PRESTON GRALLA

Three-in-One Comm Bundle

Looking for a great Windows communications bundle? Then you're in luck—you can get two great pieces of Windows communications software along with SuperStor compression software, which expands the storage capacity of your hard disk by compressing the files on it.

For a street price of around $150, you get a copy of the Windows fax software WinFax Pro 3.0, CrossTalk for Windows communications software, and SuperStor. The Communications Pak is currently available at all major retailers. Call Delrina Technology at (800) 268-6082 for details.



Great Deals on PackRat PIM

PackRat 5.0 (see page 76) has been justifiably hailed as a great Windows personal information manager. Here's the good news: You can get it cheap, and in some cases for free, when you buy certain PCs. The PIM, which normally sells for $395, will be available from Egghead Software through mid-July for $199.

Northgate computer buyers get an even better price. The PIM comes bundled free with all Northgate ZX laptops. For details, you can call Polaris Software at (800) 722-5728.

Upgrade Microsoft Office Version 3.0

For a great low-price combo of Windows apps, check out Microsoft Office for Windows Version 3.0, which includes Word for Windows 2.0, Excel 4.0, PowerPoint 3.0, and a Microsoft Mail Version 3.0 workstation license. Through the end of June, owners of Windows word processors, spreadsheets, or presentation graphics programs can upgrade for $569 (regularly $750). Owning Word, Excel, PowerPoint, or a prior version of Microsoft Office gets you a $50 rebate. Call Microsoft at (800) 228-7007 for details.

BEST SOFTWARE BUYS

Where can you get the best software deal? Usually through the mail. We surveyed mail-order houses and came up with the best prices we could find. The following prices include shipping and handling charges but not credit-card surcharges. Prices are as of press time and are subject to change.

PRODUCT	LIST PRICE	BEST PRICE	SOURCE
DOS 6.0 upgrade	$129.00	$39.00	PC Zone, (800) 252-0386
Excel 4.0	$495.00	$289.25	Computer Discount Warehouse, (800) 473-4239
Lotus 1-2-3 Plus 3.4	$595.00	$389.00	Software Add-Ons, (800) 695-8088
Microsoft Word 5.5	$450.00	$219.00	Computer Discount Warehouse, (800) 473-4239
Norton Utilities 6.01	$179.00	$106.99	Computer Discount Warehouse, (800) 473-4239
QEMM-386	$99.95	$60.00	PC Zone, (800) 252-0386
Quattro Pro 4.0	$495.00	$97.00	Software Add-Ons, (800) 695-8088
Windows 3.1	$149.00	$88.00	PC Zone, (800) 252-0386
Word for Windows 2.0	$495.00	$294.95	Computability, (800) 558-0003
WordPerfect 5.1	$495.00	$241.00	CompUSA, (800) 451-7638
WordPerfect for Windows 5.2	$495.00	$265.00	Computer Discount Warehouse, (800) 473-4239

PCContact

Shareware Tracks CPU Usage Under Windows

Windows is notorious for being a CPU hog. But do you really know how much memory it uses? Do you know if you have large amounts of CPU power left unused when you work, or do you typically work at the upper limits of your machine's capacity?

Now there's a way to find the answer. SysResources is a great Windows shareware utility that tracks your CPU and memory usage as you work. It shows the results both as a moving 3-D line graph and as a percentage of total CPU and memory use. Run the program, work as you normally would, and then every once in a while check SysResources to see what percentage of the CPU and memory you're using. If you run the program as an icon, it reports the percentage of your CPU and memory use within the icon; if you run it in partial- or full-screen size, you'll see the moving 3-D chart in real time.



SysResources is available on PC/Contact, *PC/Computing*'s online forum, as SYSREP.ZIP in data library 3 (Utilities/Misc.). The registration fee is $15. For more details, contact EB-Software, 1306 Longfellow St. NW, Washington, DC 20011.



Lexmark announces laser printers with the most intelligent feature ever:

Lexmark announces the next generation of laser printers. With the built-in intelligence to adapt to your needs today. And grow with you tomorrow.

The intelligent abilities of the new IBM LaserPrinter 4039 family by Lexmark are powerful enough to impress the most serious user. And economical enough to impress the most serious accountant.

Intelligence.



A family of five highly intelligent printers that deliver 10, 12, or 16 pages per minute. And a cost/value equation that sets a brilliant new industry standard.

There are five new LaserPrinters, for 10, 12 or 16 page-per-minute printing. Each has a fast-thinking RISC processor. A compact, space-saving footprint. And an optional snap-on duplexing attachment, for the lowest-priced two-sided laser printing in the industry.

PCL5 and PostScript® compatibility are built in—saving you up to $775 over competitive machines. And delivering plug-and-play compatibility that won't disrupt the way you're printing now. SmartSwitch is built in, too—so your LaserPrinter can choose the right language for each job, automatically.

Sharp, 600-dpi resolution is standard, with Print Quality Enhancement Technology (PQET) for smoother curves. So is Picture-Grade,™ for sharper halftones.

Intelligent memory management lets two megabytes do the work that used to take four. That saves you money.

Drivers for popular software packages are included, along with Lexmark's special driver for faster Windows™ printing. So is

THE NEW IBM LASERPRINTER 4039

Smart enough to do things the only intelligent way: yours.

From the moment you plug it in, the new IBM LaserPrinter 4039 accommodates you—not vice versa. Compatibility with PostScript and PCL5 is built in—something other printers charge as much as $775 for. So is SmartSwitch—to automatically select the right language for each job. And Lexmark's Quick Start installer and printer utilities make set-up brilliantly simple. And adding new fonts and drivers even simpler.

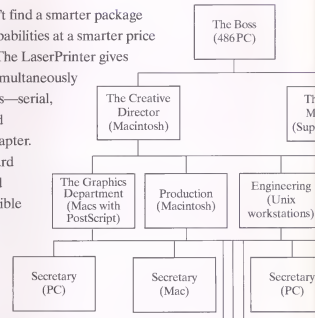


Lexmark's highly intelligent installer scans your disk for applications, then loads the right printer drivers, automatically. You're off to a smart start.

Smart enough to adapt to every corporate culture.

You won't find a smarter package of LAN capabilities at a smarter price anywhere. The LaserPrinter gives you three simultaneously active inputs—serial, parallel, and optional internal network adapter.

Choose an optional INA card (Ethernet or Token-Ring) and you're simultaneously compatible with Novell® NetWare,® OS/2® LAN Server, Microsoft® LAN Manager, *and* AIX®—all on one card. AppleTalk cards are available for Macintosh networks, too. Add our 4033 external adapter, and you expand your LAN flexibility even further.



Lexmark INA cards have bi-directional communications, and flash memory, so a LAN administrator can check printer status and download new network software, without ever touching the printer.

Every LaserPrinter 4039 has a fast RISC processor. And you can choose speeds up to 16 ppm,[1] duty cycles up to 75,000 pages per month, and powerful paper-handling options. Because LAN printing demands brawn as well as brains.



Mixed environments, multiple networks, changing languages—nothing fazes the LaserPrinter's networking skills.

As intelligent as they are, they get even smarter.

Not only is your IBM LaserPrinter on the cutting edge today. It's smart enough to stay there tomorrow. Its internal code is easily upgradable—so you can add new capabilities without paying for a whole new printer. Optional flash memory lets you store frequently



With our Registered Users Program, you can add new capabilities, without buying a whole new printer.

Exactly h
are Lexmark's ne

Sales
nager
laptop)

Marketing
(PCs)

Secretary
(Mac)

used forms, custom fonts, and logos for faster printing—yet change them as often as you like. You can add or change paper-handling options anytime, and move them from machine to machine. All of which makes this not just an intelligent printer. But an intelligent investment.



Advanced paper-handling features keep the work flowing, page after page after transparency after card after envelope after...

Smart enough to look after themselves.

The LaserPrinters' built-in smarts deliver a maximum of productivity with a minimum of fuss. SmartSwitch and hot ports automatically select the right emulation and the right port for each job. There's a large, easily readable menu-driven control panel (though the LaserPrinter is so automatic, you may never touch it).

Bi-directional communications let LAN administrators check on the printer's status remotely. Auto paper-

Lexmark's Quick Start utility, to choose and load the right drivers, automatically. That saves you time.

And a large, intuitive operator display makes installation and use even easier.

Inside your LaserPrinter, upgradable code lets you add new capabilities as they become available, without buying a new printer. Optional flash memory lets you store frequently used forms, logos, and fonts permanently—yet change them instantly.



An optional duplexing attachment fits every printer in the series. Because saving paper and file space is just plain smart.

For LAN users, Lexmark's optional Internal Network Adapter (INA) cards work effortlessly with multiple network operating systems, *simultaneously*. You can even update INA software remotely. Bi-directional communication lets a network manager check on printer status from across the LAN. And the LaserPrinter connects simultaneously to serial, parallel, and optional network inputs, for maximum flexibility.



Right out of the box, the new LaserPrinter is compatible with your working environment, whether you use PCL5 or PostScript.

The new LaserPrinters share multi-size paper trays, and high-yield Lexmark print cartridges, for up to 20,000 pages between changes.

And each one reflects the simple design philosophy of Lexmark, the independent, worldwide company formed from a division of IBM: listen to what customers want. Then build it for them. And stand behind it with quality, support, and responsiveness.



Select an optional INA card, and you're compatible with multiple operating systems—simultaneously.

For your nearest Lexmark dealer, call 1 800 358-5835 (in Canada, 1 800 663-7662). For more information, just look inside.

And see why you really don't need bigger, more expensive, more complex laser printers. Just smarter ones.

IBM Personal Printers by

LEXMARK™

Make Your Mark

FAMILY, BY LEXMARK. PRINT SMART.

Smart enough to see environmental issues from both sides.

Two-sided printing is the wave of the future—so it's an option on every IBM LaserPrinter 4039 today. A compact, efficient duplexing unit attaches in seconds, to put the intelligence of duplexing wherever you need it.

But saving paper is just the beginning. An automatic power saver mode saves electricity while your printer is idle. Lexmark's new print process is ozone free. Lexmark print cartridges last longer, so you'll use fewer. And their cartons double as prepaid return mailers—so you can return used cartridges to Lexmark's Operation ReSource. It wouldn't be an intelligent printer without an intelligent respect for the environment.

Two-sided printing saves paper, storage space, money—and wear and tear on the environment.

Lexmark's 20,000-page print cartridges keep productivity high—and cost per page amazingly low.



PRINTERS THAT THINK. FROM A COMPANY THAT LISTENS.

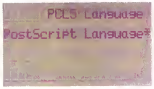
These new LaserPrinters were designed with the intelligence to anticipate your needs, and respond. So was the company that created them: Lexmark International. Two years ago, we took a former division of IBM, transformed it into a fully independent company called Lexmark, and rededicated ourselves to the art of listening. Customers told us they needed laser printers to do more and cost less. So we built the new LaserPrinter family to establish new industry benchmarks in performance. And, just as important, in value.

IBM Personal Printers by

LEXMARK™

Make Your Mark

PostScript emulation and PCL5 emulation are built in. Saving you up to $775 over some other printers.



size sensing and multi-size trays handle all kinds of paper—even card stock and transparencies. Lexmark's exclusive Envelope Conditioning[2] fights unsightly wrinkles. And every new LaserPrinter ships with a high-yield Lexmark print cartridge—saving you $25 to $100 over the competition.

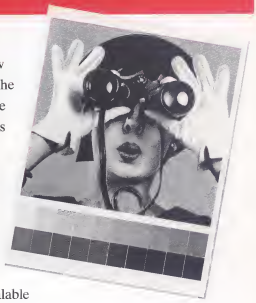
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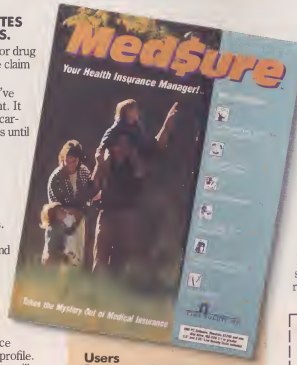
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George Burt, Lomita, CA

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Circle 108 on reader service card.

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John C. Dvorak

OK, I Admit It: There *Is* a Benefit To Pen-Based Computing

I HATE TO ADMIT I WAS WRONG WHEN I WASN'T REALLY wrong—things just changed and made it look that way. And I'm not making excuses, either.

Take pen-based computing. Dan Bricklin comes up to me at a Software Publishers Association meeting and tells me I'm wrong about pen-based computing. He pulls out the Grid Convertible that changes from a laptop to a pen-based machine with a tug of the folding screen. Whap! He puts it on the table and begins his pitch.



What he showed me was pretty nifty, I admit, but before I go into the details, let me summarize my arguments concerning pen-based computing.

Just because I critique the technology (or any other technology) doesn't mean that I believe it will never succeed. It will, sure—someday. I had qualms about the Macintosh when it first came out, and I wrote a column called "16 Reasons Why the Macintosh May Fail," listing the faults I found with the first, useless 128K machine. (The 128K was reason enough to complain.) The column became known as "Dvorak's 16 Reasons the Mac *Will* Fail." Years later, Apple has corrected 14 of my 16 complaints. On two other points—the legitimacy of the mouse and the icon-based interface—I was dead wrong. Nonetheless, I really only intellectualized a scenario where these technologies would not take hold. I never predicted they positively wouldn't be adopted. OK, it sounds like a rationalization, but nobody else defends me in these matters. (Just look at the Letters column!)

Marginal Value at First

But back to pen-based systems. First sold as a concept to gullible venture capitalists, pen-based systems were supposed to take your onscreen scribbles and turn them into ASCII text. I still laugh when I imagine the demos that had to be dreamed up to make this look like it worked. Seeing Bricklin years later with the Grid machine, I assume he had something to do with the proof-of-concept demo that had to be shown to some suckers. Bricklin, while inventing the modern, computerized spreadsheet, also invented the program that can turn any concept into a workable demo.

Within 12 months of the first orchestrated hoopla over pen-based computers came the lame excuses. "Oh, we really don't think we can do handwriting recognition." "Golly, the value of these things does not lie in handwriting recognition." And so on.

The fact is, on a pen-based machine the resolution was crummy and the screens were hard to see. I figured the potential for success was so long-range that all the current developers would be broke by the time it happened.

Then Bricklin, who drags his Grid around everywhere, shows me some intriguing features and gives me two solid reasons that a pen-based machine is nice. I already know that it's good for an insurance adjuster who has to fill out a computerized check-box form—big deal. I'm not an insurance adjuster, and only a few dozen of my readers (if any) are insurance adjusters. So who cares? All the vertical market applications bore me silly. I reckon that if the technology isn't usable by a majority of computer users, then it's useless.

First Bricklin tells me, "Look, you can't have an open laptop at a meeting or seminar because if you want to play solitaire or some game during the talk, you'll be caught." He then shows me how easy it is to place the pen computer flat on the table and to play solitaire (or any number of games). You look like you're jotting down notes. Nobody behind you or near you can see exactly what you're doing. Wow, I think to myself. This is very cool and may be reason enough to desire a machine with this capability.

The Application Justifies the Technology

Then Bricklin makes his best argument yet for the pen-based system. It has to do with saving time. I always saw the pen-based machine as a computer that cost you time. You can't write as fast as you type. You can't move around an operating system the way you can with the keyboard-mouse combo. What can you do with a pen that you can't do better with a keyboard? You can mark stuff and send it off—not a trivial concept.

Think about it. If you receive a fax on a pen machine, you can mark it with arrows, circles, and yes or no comments and send it right back—in a few seconds' turnaround time.

You can annotate a fax and send it off—not a trivial concept.

You can circle something, write a comment, and resend it. The 300-by-300-dot-per-inch resolution of the pen machine is more than adequate since the fax transmits at 200 dpi. And because the fax is kept in electronic form within the machine, it doesn't grow hairs upon retransmission. The combination of the fax, cellular phone, and pen-based machine is a technological marriage made in heaven. It's the killer app that will make pen-based computing happen—other uses are just gravy.

So my mind is changed. Pen-based computing will succeed and will be used primarily to save time in document revision and annotation.

Of course, it will always come in handy during those seminars when you really need a good game of solitaire, too.

PHOTOGRAPH BY RUEN HERNANDEZ



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Circle 245 on reader service card.

I Blew Off My Screen Saver—And I'm Glad! Glad, I Tell You!

SOMETIMES YOU JUST SNAP. IT HAPPENED TO ME A COUPLE OF years ago, when I was trying to desktop-publish a 200-page Total Quality award submission on a 14-inch Trinitron. Each time one of those monster pages would scroll, I would sit like a Warner Brothers cartoon character, my neck growing red and my face bulging like a stretched-out balloon while steam came out of my collar. Finally, at 6:30 p.m. I heard a genuine "poit!" and some interior damage broke. I got up, ran my fingers through my face, and thundered like Dumbo's crazy mother into the controller's office. "Get me a Mitsubishi 21-inch Diamond Scan right now!" I bellowed at a gentleman to whom most people speak in querulous murmurs. "What is that?" he replied. I had forgotten he was a numbers wonk, not a machine wonk.



"It's a monitor," I said.

"Fine," he said. The next morning, I got my hardware.

Handle My Fonts—or Else. Same thing happened last month, when I was watching a little box on my screen that said "Please wait" while WordPerfect for Windows updated my font list. I have more than 500 fonts. I know it sounds a little excessive, but that's the way I like it. Any program that can't handle that load can get out of here, big time. Pow. Zetz! Bye. I still do WP in DOS, don't worry. And I also want to add that I was near Orem, Utah, once for an entire summer and liked it a lot. Great canyons.

I want my machine to be my friend; that's my point. Anything that gets in the way of our friendship, I kill; that's all.

Which brings us to this morning. It took me two entire work days to select my very most favorite screen saver back last year when I was hot into the whole idiotic thing. First I wanted flying toasters, but then that seemed a little old hat. Then I went for multiplying spheres, then rolling fractal lines, but they made me want to hurl. I finally decided that I couldn't decide, so I selected Random. And it worked great. For a while.

Then this morning my boss Walt wanted to insert a three-dimensional area chart into his quarterly profit-and-loss statement that he sends to our corporate parent in Ypsilanti. I guess because for the first time in six quarters we have a positive story to tell, he wanted a pretty picture. For me this involved making the chart itself in Harvard Graphics for DOS, then importing it into Ventura Publisher for Windows as an HPP file. As the object redrew itself on the screen, I went to get a cup of coffee. When I returned, the earth was slowly bouncing around my Diamond Scan, all green and blue and white on a sea of black. "Drat," I said. I moved my mouse, and the screen once more started to redraw itself. Then my pal Finster called with a joke I had already heard, but I had to listen to it anyhow, because it's possible he'll be promoted next month. At the exact moment he got to the punchline, a humongous bolt of lightning cut through the skyline on my screen and a devastating crunch of thunder made me leap at least six inches off my chair, butt first. I slammed into the mouse, cursing. "$%*&@#," I said. The screen once again started to redraw its cross-hatched mountain ranges of profit and loss, at about the speed that Europe will unify its currency. Metz, our VP of Substantial Things, then dropped by with the 14th draft of the marketing plan, which clearly needed revision. When he was gone, I turned back to my screen to find little animal eyes winking out at me from a dark forest and plenty of crickets chirping. What I yelled then I cannot print, in deference to my friends in Utah. Suffice it to say I made a rude noise, terminated VP.WIN, exited Windows, and launched Norton Commander with grim determination. I knew what I was about to do. And I was frightened.

Into the Abyss. When I blew off the After Dark directory, a faint, guttural scream emerged from the hard drive. When I went into WIN.INI, I could swear I heard a distant "No!" seep out of the back of my housing. And when I blasted all references to the poor thing from my configuration, the moaning and keening from the entire right side of my office could be heard all the way down the hall. I don't know why nobody stopped by to ask me what the hell was going on.

It was sad. But it had to be done.

Now that it has, I'm not going back. I'm not interested in what happens to Johnny Castaway, for instance. Actually, I am, but I'm not going to give into it. I don't need the thumping pink Energizer bunny to crack up my colleagues, although it certainly would. And I don't believe I want to be sitting around one afternoon, attempting to eat, snooze, or dream as my job description entails, and end up being

Get out of my config files, you stupid Energizer bunny!

peeled off the ceiling after the voice of First Medical Officer "Bones" McCoy bleats, "Look, he's dead, Jim!" from my Sound Blaster. If I ever do cave in, I'll eat the software of your choice. I'm serious. Send it in. We have photographers here who'll chronicle the entire process. Watch me munch 2MB of VGA wallpaper, if you like. Actually, a lot of that stuff looks pretty tasty.

There are moments when I long for the way things were before. But I'll take it a day at a time. And eventually, I'll recover. When I do, I'll take the next step . . . I'll blow off those idiotic Hollywood sound bites that scare the hell out of me when I hit the wrong key! Zap! Bweee! You're dead, you stupid, useless vanity program!

Here's not looking at you, kid. Or listening to you, either!

PHOTOGRAPH BY RICHARD BORGENICHT



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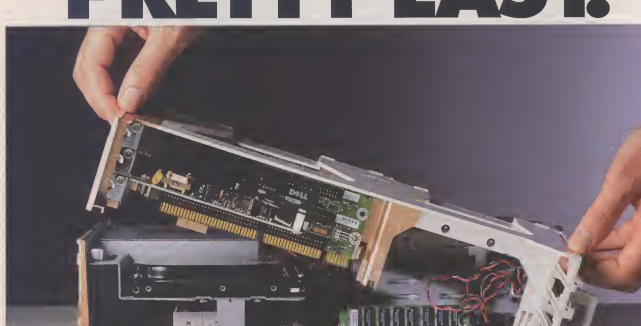
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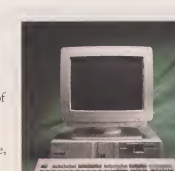


Or if you want to get to your hard drive for easy maintenance or for an upgrade, just take out another screw, unplug two cables, and snap it out.

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John Dickinson

The New PC Lingo: Counterintuitive, Antirevolutionary, and Most Uncool

NOT LONG AGO, PRODUCT MARKETERS AND THEIR PUBLIC relations and advertising allies favored a complex code of technical-sounding acronyms to describe their products. Nonwords such as ASCII, NetBIOS, NetBUI, C++, OOPS, and TCP/IP made ordinary products seem state-of-the-art. But everyone has become tired of the practice, so a new code has arisen, one that sounds less confusing because it's made up of familiar words. The trouble is, the new code is no less obfuscating than the old one, and each word is loaded with double meanings and triple entendres. Herewith, a few of the more offensive examples:



PHOTOGRAPH BY REG SPARSON

Rich, as in *rich feature set,* or *feature-rich,* is supposed to indicate a vast number of sophisticated features that interact well. In truth, it more often means "This stuff is too complicated to explain to a dufus like you" or "I haven't a clue as to what all of this is supposed to be for." Excessive use of *rich* often occurs after engineers take over product marketing, which results in inexplicable product features. Sometimes it's used by writers to cover the fact that they don't understand what they're talking about.

User-friendly implies that software can actually be your friend, which is nonsense, or that software can be easy to use and understand, which is unlikely. While *user-friendly* does frequently refer to products that are easier to understand and use than the DOS prompt, they are usually no friendlier than Atilla the Hun.

Intuitive refers to software interfaces that are supposedly obvious because they follow the natural tendencies of the human mind. Since there's nothing natural about computers and software, the term is nonsensical. It's shorthand for "You're an idiot if you can't figure this out" or "Look, I don't understand this, but if you do, we're home free."

Robust is supposed to mean that the product will do anything you want or that it won't crash under any circumstances. It most often means that the product does nothing useful, or at least nothing useful to you, and that it frequently bombs.

Client-server is a term that even on the most scientific grounds is open to interpretation. It's supposed to indicate an intelligent relationship between a network server and its PC clients, but it's more generally used to indicate that there's a file server somewhere in the vicinity. It's a dandy substitute for "You can load the program from the server," "Data can be accessed from the server," "Network printers can be used," or even "The program works OK while you're logged on to a server."

Engine once referred to the machine that runs your car, but lately it means something that runs your application. It's frequently used to indicate that there's some core logic in a program. While this logic is supposed to be transferrable to other products, it never has been. *Engine* is often used to indicate a program's mere existence, as in "The word processing engine formats text."

Multiplatform is supposed to mean that a program runs on several platforms, but usually means that a program *could* run on those platforms. For example, "Windows NT is a multiplatform technology" really means that Microsoft programmers are chained to their keyboards trying to make the thing run on DEC's Alpha chip. "Simultaneously developed for the Mac and PC platforms" means only that a Mac version of the product is being considered.

Works the way you do has only recently come into vogue. It's supposed to suggest that you and the program will get along famously but usually it means that it works the way some software engineer wants it to work. Generally, the program doesn't work very well at all.

Revolutionary is supposed to describe a program feature that's so new it will radically change the way programs work. It more often describes something originally developed for mainframe computers 25 years ago.

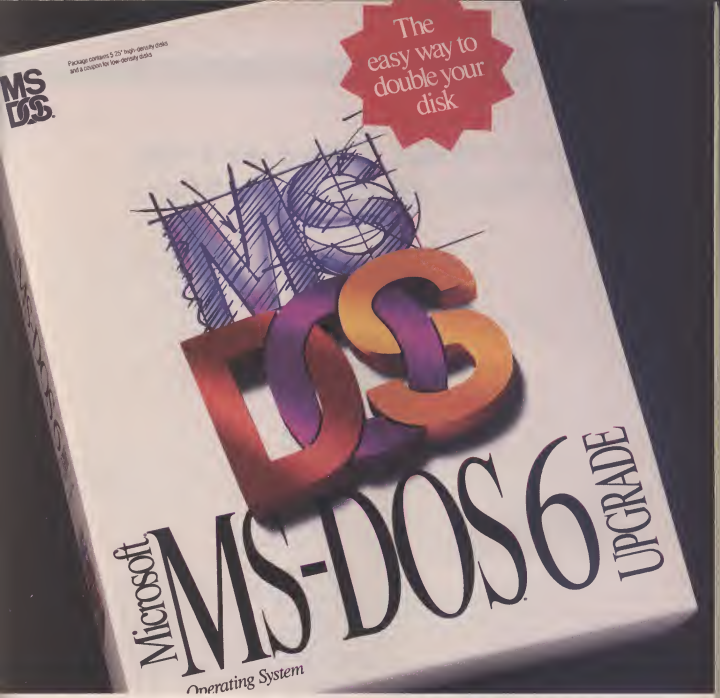
Object is truly revolutionary in the above sense because, while the modern definition is a code-data entity that can move and act on its own within or between programs, it more often resembles the subroutines, overlays, and function calls originally developed for structured programming more than 20 years ago. *Object-oriented* is most often a fancy phrase for programs that were planned that way.

Paradigm is supposed to indicate that a program conforms to some ideal outside of the computer industry. It more often means "The program was supposed to work like a framus and has buttons and other things that are just like what you might expect a framus to have if it worked on a computer, which of course it doesn't. The program actually works like something else."

The words may be familiar; the meanings are purposely obscure.

Transparent is supposed to mean that you won't notice a program's presence at all while you use it, or at least that you won't notice any changes from one version of a program to the next. On those terms no program is ever transparent. In fact, the word normally covers for programs that are so invasive you might want to switch off your PC as soon as they start up, or it's used to explain why new versions of a program are unrelated to old ones.

Cool is straight out of the 1950s, as in "Cool, man." If you've heard this word too often, you've spent too much time listening to Bill Gates. But it does mean what it says.



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Gina Smith

Taligent's Pink: A Red-Hot OS, But Oh Those Marketing Blues

I USED TO THINK PINK COULD MAKE IT. BUT NOW THAT I'VE SEEN the marketing effort behind it, I think this thing's in danger.

Pink is the code name for the 100 percent object-oriented operating system being developed at Taligent, the independent company Apple and IBM spun off last year. And technologically speaking, Pink will be hot. When it ships in late 1994 or early 1995, insiders say, it will run virtually any application—whether it's written for DOS, Windows, the Mac, or Unix.



PHOTOGRAPH BY JOCK MCDONALD

You say you don't need object-oriented software? Don't kid yourself: Today's sophisticated graphical software barely works, because the development tools and operating systems used to build it were never intended for projects so big. Programmers practically have to rewrite whole applications just to get out an update that crams in all the latest features. And we end up with buggy software, late updates, and programs that chew up hard disk space like crazy.

All it takes to solve this problem is the combination of powerful object-oriented apps running on top of a lean, mean, object-oriented OS. But Pink won't be that operating system—which is sad, considering how badly we need it.

Cheaper, More Reliable Apps

It's no coincidence that Microsoft, IBM, Apple, and Taligent are all working to make their software interfaces object oriented. An object-oriented interface lets developers create feature-specific, reusable modules of code instead of monster applications that try to do everything. The result will be cheaper, more reliable software that hits the market faster.

But the great thing about an object-oriented interface is that it lets you buy a single "base" application (a word processor, say) and get very specific add-in modules for e-mail, number crunching, drawing, or whatever, only as you need them. Beyond the obvious cost benefits, that means retraining won't be an issue: When you need new capabilities, you'll just add them as options to the base application that you spend all your time in anyway.

An object-oriented interface on your operating system will let you forget about applications and just deal with data instead. Talk about usability. This means our computers will finally work with information the way our brains do—without switching into some arbitrary "word processing" or "number crunching" mode whenever we need to write or calculate. And it's about damned time.

The Pink Difference

But it gets even better if the OS itself is object oriented instead of simply having a slick interface on top. That's the difference between Pink and other planned object-oriented products like Microsoft's Cairo and IBM's Workplace OS. Because the whole OS is broken down into groups of objects (Taligent calls them frameworks), you'll be able to add complex system-level capabilities and functions—not just the applications modules that object-oriented interfaces allow.

Say you want to add a network. You would buy a network module capable of fitting quickly and seamlessly into the rest of your operating system. That's possible because the OS will already be built to receive the module—so there are no annoying drivers and IRQ hassles to deal with. Compare that to the hours of torment required to install a network on OS/2 or Windows, and I think you'll see the point.

As for current applications, insiders say Taligent is trying to create the ultimate integrator—capable of running DOS, Windows, Mac, OS/2, AIX, and AUX applications right out of the box. And insiders say it'll work that way whether you're using Pink on a Compaq Pentium–based PC, or a 68060-based Mac III, or the souped-up "Power PC" that will be selling for under $4,000.

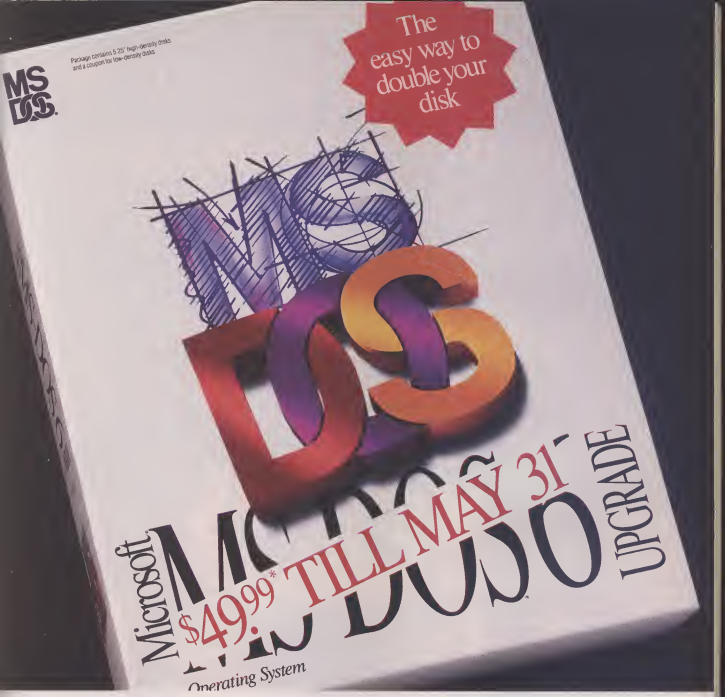
The Missing Link

So if Taligent's new operating system will fill so many needs, why won't it become a huge success? In a word, hype. There is absolutely none of it coming out of Taligent's headquarters. This is a serious problem. Hype builds momentum, which builds market share. Knowing this, most applications developers won't even touch a product unless it's been promoted for years in advance of its arrival. Hype gives them the feeling that someone will actually buy their applications when they're ready.

It's a brilliant strategy, letting customers and developers in early. Microsoft knows what IBM, Apple, and Taligent are ignoring: Forget about keeping your product secret until it's ready. Get people excited about what you're working on and they won't even bother checking out what's already available. They'll be happy to bandy about your "secret" code names at cocktail parties. And they'll wait around for you.

Microsoft could teach Taligent a thing or two about vaporware.

But when it comes to hype, Taligent doesn't have a clue. Its execs claim that despite its rich IBM and Apple parents, it's too small to be visible and vocal. Maybe. But all the ground-breaking technology in the world can't change the fact that these days, without hype, you can't get anyone to write apps for your OS. And without Pink-specific apps, what do you want Pink for? Unless Taligent wises up quickly, Pink is bound for a terrible fate: status as a historical curiosity and as a marketing warm-up for Microsoft.



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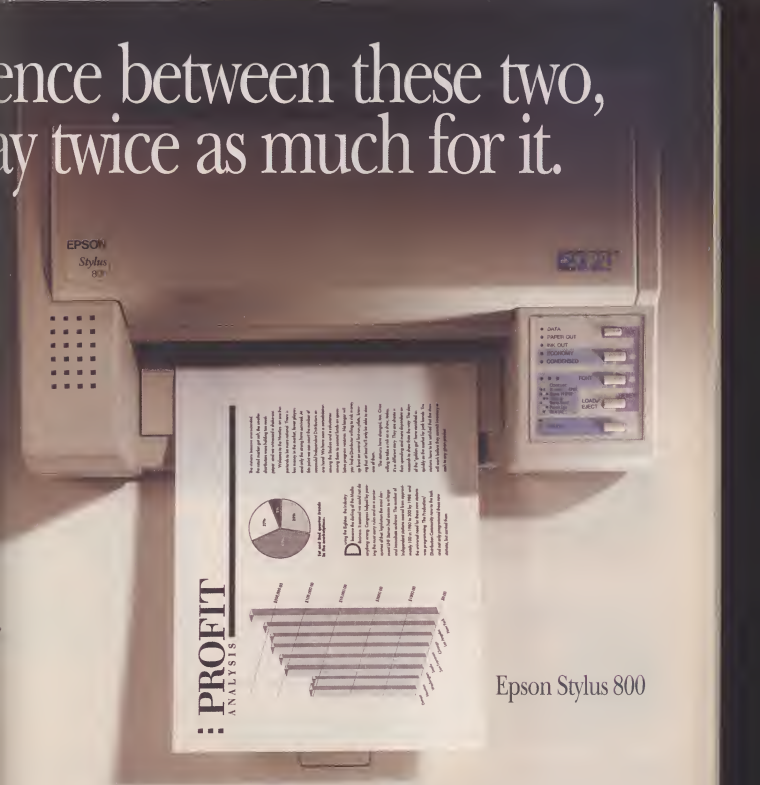
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Pentium Fever Strikes: Industry Delirium or Ingenuity?

AFTER MANY DELAYS, INTEL'S PENTIUM IS FINALLY HERE. Early benchmark tests show that this long-awaited CPU is far faster than the current 66MHz 486 speed champ. But wary of cannibalizing its profitable sales of older-generation CPUs, Intel for now is pricing the Pentium beyond the reach of many users and limiting the supply to PC makers. Is there a Pentium in your future? John and Paul, once again, disagree.





PHOTOGRAPH BY RUVEN AFANADOR AND RICHARD MORGENSTEIN

SOMERSON: So John, have you caught Pentium fever yet?

DVORAK: Well, you and I will both be using the Pentium chip once it works. I think that's the key. This chip has been talked about for almost a year, as if it's ready to ship. But I don't think we're going to see much of it until next year. Pentium fever? No way.

SOMERSON: What's the matter, John? Got something against speed and power? The first Pentium on the market is nearly twice as fast as the speediest 486, and five times the speed of a garden-variety 33MHz 486. And that's using existing tests; on apps compiled for this CPU-with-the-wacky-name, it'll run even faster.

Intel could pump out the chip, but it's making too much money by selling 486s. So it's holding back production and keeping prices in the stratosphere. This is what happens when a company doesn't have any competition. Imagine what things would be like if AMD hadn't lost the 486 lawsuit. Intel would be claiming that the 486 was a pig and that you couldn't get any work done unless you popped in a Pentium.

DVORAK: For some unknown reason you've equated my skepticism with my desire for the latest and greatest. Let's see, with the DX3 coming out at 99MHz to 100MHz and the Pentium maybe hitting 60MHz, I don't see how it's twice as fast. But maybe you have some new way of figuring things. You've obviously seen and used the Pentium. Good for you. You must even have one.

SOMERSON: Duh. Of course I've seen Pentiums; that's my job. I wouldn't form an opinion about it unless I had actually tested one. Of course that's never stopped you, John.

And no, I don't have "some new way of figuring things." But Intel did when it designed this "586" chip. Its CPU has more than twice as many transistors as the 486. It has two instruction pipelines to the 486's one, and its superscalar architecture processes two instructions at the same time. This chip comes with a mainframe-inspired branch predictor unit to make the pipelines work even faster together.

It was built for a 64-bit data bus, which is twice as wide (and potentially twice as fast) as the one in even the best 486 systems. It comes with two internal 8K caches—one for data and one for instructions—while the humble 486 piddles along with just one. And these are set-associative write-back caches, not the thrash-happy write-through caches of the 486. The Pentium caches can handle writes as well as reads, and they use an internal CPU bus that's twice the width of the one on the 486. Intel also completely redid the internal math coprocessor to add pipelining and streamline things even more. Besides, future Pentiums will obviously be goosed to speeds far faster than the clock-tripled 486 vapor-chip you're slobbering over.

The advance specs we've seen have big-name vendors stuffing two, four, or even eight of these babies inside a single PC. This is the chip IBM has been dreading for years—the mainframe killer.

DVORAK: Good for you, Paul. Now you sound like some Intel spokesperson. The sun shines bright on Intel—they can do no wrong. And somehow you have a Pentium computer at your desk. Oh wait, you're not talking about some demo you were shown, are you? You have one at your desk that you use day in and day out? I see demos all the time. Funny how things in real life never work like the demos. I'm sure over time the 586 will be a screamer. But geesh, I thought it had some bugs. Now, I see that it's unbelievable and flawless! OK, I'm sold. Now where do I get this computer you're using that has this marvel chugging inside?

SOMERSON: Glad to see you come around, John. Who's producing these silicon scorchers? Every company from *A* to *Z* has at least one Pentium PC poised to go. Of course (as we write this) none of them will admit it publicly, since Intel has hinted that chatty vendors might just suddenly find the pricey CPUs in short supply. Loose lips sink chips.

DVORAK: Poised to go? The fact is that the Intel assembly line is jammed with demand for 486 chips. The Pentium is



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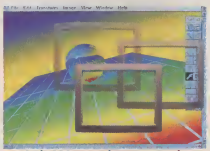


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not running well and these guys are poised. Well, I'm poised to test. And I don't mean test prototypes—I mean a real machine in the real world. So where is it? The word on the street is that the 66MHz 586 is about 40 percent faster than the 66MHz 486 anyway. I prefer a technology that doubles or triples my speed. The 99MHz 486 will be faster than the Pentium. That's the chip I'm going for in the next machine. Someday the Pentium will come around and I'll go with it. Or maybe if I like Windows NT I'll find a nice Alpha machine and give up on all this nonsense. Probably not.

SOMERSON: Great, go ahead and stock up on Alpha machines so you can add some more curiosities to your collection of non-standard hardware that never went anywhere. Put them next to the PowerPC, MIPS, SuperSparc, and PA-RISC systems, and then when the cobwebs get too thick, truck the whole shebang to the Nice Try wing at the Computer Museum.

DVORAK: I like to see people who are so open-minded about change. Not! Why don't you just put on an "Intel *über Alles*" T-shirt and a Microsoft baseball cap and go back to your desk.

SOMERSON: John, you're in one of your reality-distortion fields again. Look, first of all, standards in this industry are rare, and ×86 compatibility is one of the welcome few that have prevented nightmarish PC Balkanization. Intel clearly wins here, even against a rocket like the Alpha. Second, in such a monopolistic position, Intel can obliterate any vendor that doesn't play ball. The only defense against this is a unified front of rebels, and every attempt at such an alliance in the past has crumbled pathetically. Intel plays these guys against each other and wins again.

Third, software runs even better on the Pentium when it's specially jazzed to take advantage of the new architecture. So you'll soon see a class of big-name superapps that work best only on the Pentium. Now think hard . . . what are you going to buy, the slow old kind or the fast new Pentium-enhanced ones? Another slam dunk for Intel. Finally, while Intel used to start work on the next-generation chip only after the previous one was coming off the fab, it now overlaps several generations of CPU development at once. Someone happens to come up with a Pentium-popper and suddenly the Sexium or whatever they call the 686 is on the market. Besides, do you think clock doublers and triplers are limited to the 486? Could Intel possibly have double- and triple-clutched Pentiums in the works? Gee.

DVORAK: I'm falling on the floor laughing as you say that "software runs even better on the Pentium when it's specially jazzed to take advantage of the new architecture." What "specially jazzed" software has been written to prove this? None! We have seen iteration after iteration of Intel chips that allow "jazzed" software to be written for each chip, but developers still write 8086 code. What idiot would write Pentium-specific code when there are 75 million machines out there that will run 8086 code? Get real. As for clock doublers and triplers running on the Pentium, I'll believe it when I see it.

SOMERSON: Dvorak, if you and all the other faded lefties who hate success had their way, all big companies would be busted apart, and we'd all be hopelessly stuck sifting through the splinters of a fragmented market with no standards whatsoever. Intel and Microsoft both produce solid stuff. But more important, both provide desperately needed leadership and standards for the industry.

And you're just plain wrong about the Pentium. Do your homework for once. I'm on the road as I write this, talking to a giant software company that's very excited about compilers that will let them take special advantage of the new architecture of the 586. And it's just one of many. As usual, a year or two from now everyone will quote you and laugh.

You're also out to lunch about developers' past efforts to use newer features of Intel chips. Why do you think Windows can't run decently on anything older than a 386? Could it have anything to do with harnessing CPU features that weren't in the ancient 8086 that you worship? Are all Windows programmers the "idiots" you referred to because they've abandoned tens of millions of 8088s? Give me a big break. Do you know how many 586s Intel expects to sell over the chip's lifetime? We're all going to upgrade to it in the next year or two, even you. And, despite your ignorant bluster, we'll all be running software specially compiled to work better on it, and we'll be using 586 clock doublers and triplers based on the technology Intel pioneered successfully with the 486. So stop whining and get with the program already.

DVORAK: Wow—you really are a mouthpiece for big companies—and proud of the fact, it seems. Good for you. Heaven forbid that anyone should question the motives or demos of these big companies. I'm sure they're tickled pink that you stand up for them. Those poor helpless monsters. Every month you imply that I'm some sort of communist just because I don't toe the fascist line laid down by these big companies whose sole motivation is more money in their coffers. Do I serve the public by walking lockstep to their tune—whatever it is at the moment? I'm sorry you feel that Intel can do no wrong and that everything is peachy keen. Fact is, everything isn't peachy keen and the Pentium is a long way from dominating the market. Maybe in a year things will be different. For now, *nyet!*

This is the chip that IBM has been dreading for years—the mainframe killer.

SOMERSON: Chill out, John. I really do care about personal computing. Do you? Your arguments make you out to be some sort of twisted nihilistic cheerleader for holding back technology, and for advancing the kind of dangerous no-standards anti–big-business industry fragmentation that will drive both developers and buyers crazy.

Of course Intel isn't perfect—who is? But consider this—they didn't have to release the Pentium this early; they could have waited until the 486 bonanza started drying up. They're going to ship a staggering 40 million 386s and 486s this year. But instead of playing it safe, they're pushing the envelope, advancing the industry, and giving power junkies like you and me better products right now. Wait until you get your hands on one. You'll come around.

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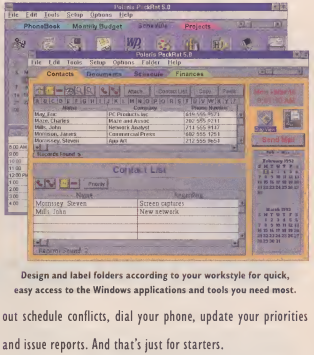
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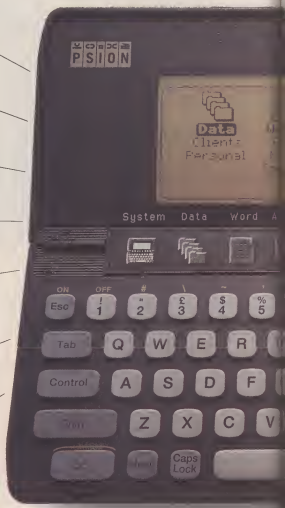
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plan a budget (1-2-3 compatible)–or do almost anything you'd do on a desktop. And with optional links to connect your Mac or PC and even a software developer's kit–you've got a computer that will grow to meet your needs in a package that fits your pocket. Why buy an organizer, when you can have a computer? Call **1-800-54-PSION** for more information on the Series 3 or the dealer location nearest you.



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HARDWARE BUYER'S SUPERGU

The 200 best hardware products you can buy

What hardware is absolutely, positively the best that you can buy?

The future of your business could ride on the answer. And that's the single-minded obsession behind this special issue of *PC/Computing*. To produce the 1993 Hardware Buyer's Superguide, we teamed up with ZD Labs for the most exhaustive PC product review in history. We started with tens of thousands of products and pared the list down to under 1,000 through a critical analysis of technologies and pricing trends.

Next, our team of 134 editors, reviewers, usability experts, and lab technicians spent 25,000 hours and upward of half a million dollars on comprehensive hands-on comparisons of 532 products in 25 essential business categories. After four months of intensive research and testing, we identified 200 products that represent today's best choices for business.

Before we touched a single product, though, we interviewed real business buyers from a broad cross-section of American companies. These conversations confirmed what perceptive business buyers have always known: When it comes to hardware, one size definitely doesn't fit all. A 486 color notebook may be just the ticket for a fleet of salespeople taking presentations on the road, but a light, cheap 386 notebook is a better solution for a budget-conscious department that needs a rugged e-mail terminal. The dazzling 20-inch monitor that's ideal for the marketing department would be overkill in accounting. Fact is, no single product can possibly meet all the needs of every business.

BEST SYSTEMS 130

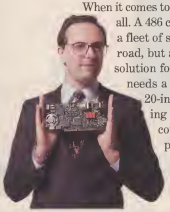


BEST NETWORK HARDWARE 158

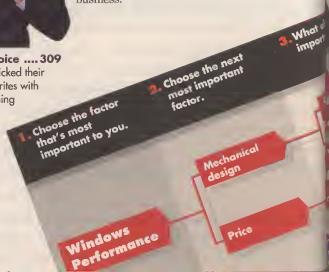


BEST PRINTERS 184





Editors' Choice 309
Our editors picked their personal favorites with some astonishing surprises.



Our 134 editors and testers cracked the cases on 532 products to discover the best 200.

IDE



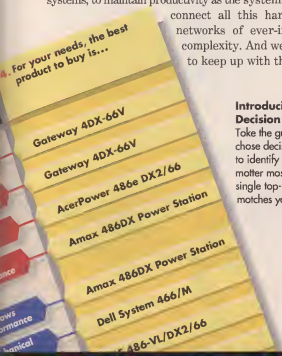
The top-rated product in each category represents the right choice for the majority of business buyers, but what if your business priorities don't match our model? That's where the *PC/Computing* Decision Maker comes in. In each category, you'll find our product recommendations based on varying combinations of significant factors. Follow the road map to pinpoint the product that most closely matches your specifications.

Why Hardware? And Why Now?

Hardware is the engine that makes powerful new applications possible. And when it comes to buying hardware, there's no margin for error.

These days, hardware buying is an ongoing process, not an annual ritual. We buy new systems and peripherals constantly, always in search of more productivity and a greater competitive edge. We gut existing PCs and replace key components, like hard drives and video subsystems, to maintain productivity as the systems age. We connect all this hardware in networks of ever-increasing complexity. And we struggle to keep up with the pace of change and make the right buying choices.

The *PC/Compnting* Hardware Buyer's Superguide is a one-stop information resource for any business that buys hardware. We explain how products benefit your business, how to choose wisely for your company, and which products to buy. And, be sure to check out the *PC/Computing* Decision Maker: There's no faster, more accurate way to make your next hardware purchase decision.



Introducing the *PC/Computing* Decision Maker

Take the guesswork out of hardware purchase decisions: Use the Decision Maker to identify the product attributes that matter most to you and discover the single top-flight product that perfectly matches your needs. It's that simple.

BEST VIDEO 218



BEST STORAGE 262



BEST PERIPHERALS 280



The Experts Who Made the 200

All told, 134 people at *PC/Computing* and ZD Labs worked to make the *PC/Computing* Hardware Buyer's Superguide comprehensive, technically accurate, and jam-packed with useful information to help you find the best computer hardware around.

From *PC/Computing*: Linda Ackerman, Jean Atelsek, Cyndy Bates, Bob Bayley, Peggy Berg, Ed Bott, Sharon May Brown, Mark Brownstein, Beth Cataldo, Jozelle Cox, James Cury, Anita Dennis, Meredith Downs, Timothy Edward Downs, Scot Finnie, Nathan Garcia, Posy Gering, Deborah A. Gravitz, Christine Grech, Mark Haas, Jeannette Hodge, Kate Hoffman, Regan Honda, David Ivie, Marty Jerome, Dave Johnson, Claire Keaveney, Liesl La Grange, Matthew Lake, Lydia Lee, Dale Lewallen, Mark Li, Martin Marshall, Adam Meyerson, Becky Neeley, Sally Neuman, Denise E. M. Penrose, Rebecca Perry, Sebastian Rupley, Chris Sandlund, Donna Sharee, Gina Smith, Peggy Smith, Paul Somerson, John Taschek, Wendy Taylor, Dylan Tweney, Peggy Wallace, Laura Watt, Ron White, Christine Whyte, Michael Yapp, Marilyn Young, Molly Zahner, Sally Zahner, and Charlotte Ziems.

From ZD Labs: Nitin Akarte, Shannon Akegarasu, George Allen, Lenny Bailes, Adam Baum, Marty Beaudet, Brian Booher, Laura Brown, Tony Brown, Rick Brzuchalski, Allen Chan, Stephen Chan, Paul Chou, Shahid Choudri, Michael Clasen, Jeff Davis, Kristina DeNike, Will Driscoll, Andrew Eisner, Anita Epler, Rob Ferguson, Rickey Fisher, John Fletcher, Rob Fontanosa, Paul Freedman, Bill Fullendorf, Ed Griffin, Joey Hertzbach, Grace Ho, Vinnay Kalra, Bob Kane, James Kelleher, Craig Keller, Dave Kong, Doug Leadenham, Amy Leung, Mark Lindberg, Gerardo Menalac, Julian Milenbach, Ben Miller, Jim Nell, Hui Nguien, Paul Nguyen, Mike Noe, Mark Opheim, Ed Osborn, Yvonne Oung, Ron Pannus, Hitendra Patel, Nat Poor, Shivashankar Ramani, Mike Ramirez, Camille Riddle, Ken Ritter, Blake Roberts, Colin Safreed, Dan Scanlon, Kern Schireson, Raju Shah, Emily Shieh, Nina Smith, Tim Stefanini, Dave Step, Ryan Tabibian, Joel Taylor, Lisa Valdez, Miguel Vargas, Lisa Villanueva, Joe Virzi, Winston Wang, Paul Weidler, Don Wilkinson, Jim Wolf, Martin Wong, Jae Yang, Brian Young, and Ray Zhou.

Who Makes the Best Hardware?

These ten elite computer companies each placed four or more winning products in the *PC/Computing* Hardware Buyer's Superguide.

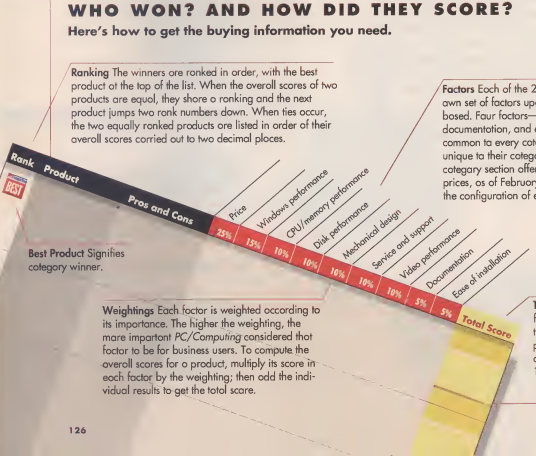
Company	Number of Products
Hewlett-Packard	**10**
Epson America	**6**
NEC Technologies	**6**
Nanao USA	**5**
AST Research	**4**
Compaq	**4**
Dell	**4**
Kraft Systems	**4**
Tandy	**4**
Zenith Data Systems	**4**

WHO WON? AND HOW DID THEY SCORE?

Here's how to get the buying information you need.

Ranking The winners are ranked in order, with the best product at the top of the list. When the overall scores of two products are equal, they share a ranking and the next product jumps two rank numbers down. When ties occur, the two equally ranked products are listed in order of their overall scores carried out to two decimal places.

Factors Each of the 25 product categories has its own set of factors upon which evaluations were based. Four factors—price, service and support, documentation, and ease of installation—are common to every category. Other factors are unique to their categories. The first page of every category section offers factor definitions. List prices, as of February 19, 1993, are based on the configuration of each product as tested.



Best Product Signifies category winner.

Weightings Each factor is weighted according to its importance. The higher the weighting, the more important *PC/Computing* considered that factor to be for business users. To compute the overall scores for a product, multiply its score in each factor by the weighting; then add the individual results to get the total score.

Total Score The bottom line for each winning product is this single number, computed to one decimal place on a 1-to-100 scale—where 100 represents perfection.



Colorful Travel Companion

From New York to San Francisco, from Taipei to Brussels, everyone has to make more efficient use of their time. With 486 CPUs, including a screaming 66MHz DX2, and three screens to choose from, Twinhead has created a world-class line of notebooks with a model that's just right for you (and your budget). A built-in trackball makes portable Windows computing a reality. User installable memory and fax/modems are available to suit your needs. All this in a package that is truly letter sized, standing less than 2 inches high. Make the Slimnote your Travel Companion. And don't just take our word for it...

intel inside

	Available Displays			Hard Disk	
	Active Color	Passive Color	Mono	130Mb	200 Mb
Slimnote 4DX2/66	YES		YES		YES
Slimnote 4DX/33	YES	YES	YES	YES	YES
Slimnote 4SX/33		YES	YES	YES	YES

PC Computing Best Value 11/92 Slimnote 4SX

PC World Best Buy, 8/92 Slimnote 33XL

Infoworld, 12/21/92 Buyer's Assurance Award Slimnote 4SX

Every Slimnote comes with a one year ExpressCare™ service warranty that delivers fast service when you need it. Toll-Free lifetime technical support is also included.

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Rated #1 in 486 Service and Support by PC World*

While others come and go, Austin's been in business for over eight years — with a phenomenal 75% customer repeat purchase rate!

Why? To begin with, we offer award-winning machines at a fair price. We've won five PC Magazine Editor's Choice Awards in three years.

Each system is built to your exact order. We configure the system, format the hard drive, and install your new software.

Plus, we use only top-notch components. For the price of our competitors' regular systems, we offer VESA Local Bus Systems...Windows™ users will see an *immediate* difference. Intel architecture and quality components make upgrades easier and lower your cost of service.

We also offer a two-year parts and labor warranty, technical support 7 days a week, 30-day money-back guarantee, and FREE on-site service for one year. Extended warranties are also available.

Powerful systems. Leading-edge technology at a fair price. Service and support rated #1 by PC World. No wonder our customers keep coming back!

ALL SYSTEMS INCLUDE THE FOLLOWING UNLESS NOTED:

- 1.44MB & 1.2MB Floppy Drives
- 101-Key Keyboard
- Microsoft Mouse
- Pre-Installed MS DOS, Windows and Choice of Application Software

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Arguably the Finest™ Caviar® WESTERN DIGITAL

Novell Gold Authorized Reseller

486/DX2-50 VESA-LB Patriot

- 1MB VL-Bus Windows Accelerator
- 4MB Memory
- 128KB Cache
- 170MB Hard Drive
- 14" Super VGA NI Monitor
- Choice of Application Software

$1989



*PC World, February 1993, Review of 486 Systems.





486/DX2-66 VESA-LB Patriot +

- 1MB VL-Bus Deluxe Windows Accelerator
- 8MB Memory
- 256KB Cache
- 340MB Hard Drive
- 15" Super VGA NI Color Monitor with Digital Controls
- ZIF CPU Socket
- Two VL-Bus Slots
- Choice of Lotus® Application Software

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486/DX2-50 VESA-LB Patriot +

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- 8MB Memory
- 256KB Cache
- 250MB Hard Drive
- 15" Super VGA NI Color Monitor with Digital Controls
- ZIF CPU Socket
- Two VL-Bus Slots
- Choice of Lotus® Application Software

$2499

486/DX-33 VESA-LB Patriot

- 1MB VL-Bus Windows Accelerator
- 4MB Memory
- 128KB Cache
- 250MB Hard Drive
- 14" Super VGA NI Color Monitor
- Upgradeable CPU
- Choice of Application Software

$1899

486/SX-33 VESA-LB Patriot

- 1MB VL-Bus Windows Accelerator
- 4MB Memory
- 128KB Cache
- 250MB Hard Drive
- 14" Super VGA NI Color Monitor
- Upgradeable CPU
- Choice of Application Software

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PCs That Mean Busi

Powerful desktop systems and notebooks that give you a

You'd think the past year's price wars would've made PC buying a little easier.

Guess again. A year of vicious infighting has resulted in not only fantastic pricing but affordable options in CPUs, graphics, storage, and design as well. Of the 112 systems we tested, we saw nine types of CPUs, seven types of integrated graphics circuitry, and five varieties of hard disk controllers. To save you some legwork in evaluating all these options, we've assembled a buyer's guide to finding your ultimate system.

Whether you find the desktops or notebooks you need here or custom-configure your own, this article will help you outfit your business with all the computing power you will need to run today's—and tomorrow's—high-powered applications and operating systems.

So Many Choices

What will it be: A PC or a notebook? A high-performance 486 desktop or one of those bargain jobs?

Of course, your primary concern is making sure you've got the right hardware for your business applications. With that in mind, we've tested PCs in four categories that run the price/performance gamut: high-performance PCs, low-cost PCs, 486 notebooks, and 386 notebooks. Here's a rundown of our recommendations.

Top of the Line: High-Performance PCs Based on either of two top-performing 486 CPUs—Intel's 66MHz 486DX2 or 50MHz 486DX—these systems make Windows soar. And because DX2 and DX CPUs include 8K of internal cache as well as a built-in floating point unit (FPU), these desktops also make fine machines for CAD, statistical-analysis, and other number-crunching apps.

Ten of the 25 high-performance systems we tested came configured with a 66MHz 486DX2 CPU, 8MB of RAM, a 100MB or larger hard disk, and local-bus graphics—ideal for running Windows. Prices for 486 systems have fallen significantly (see "Time Is Ripe to Buy a 486," at left); all these systems cost around $4,000 or less.

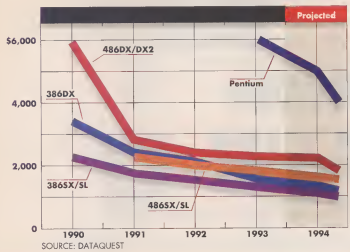
Performance for Less: Low-Cost PCs Since low-cost 486SX desktops are based on chips without FPUs, they don't excel at heavy numerical tasks. But correctly configured, they are excellent systems for running standard Windows business applications. Look for a system with a fast hard disk and some quality graphics accelerator circuitry. And don't pay more than $3,000.

Trim and Fit: 486 Notebooks For the first time, 486 notebook PCs are every bit as powerful as desktops (see "The Perfect Notebook," page 133). They're more expensive, though, because they incorporate the costs of both miniaturization and individual components (see "Going Mobile," page 132). Ideal for users who need a full-time, portable system for on-the-road business and presentations (see "Batteries Keep On Going," page 132), the systems in our 486 notebook category typically include at least a 20MHz 486SX with a 120MB hard disk and 4MB of RAM. The optimal configuration combines an active-matrix color screen, a removable hard disk, a built-in pointing device, a 9,600-bit-per-second modem, ample battery power, and—please!—full-size function keys. All that convenience

TIME IS RIPE TO BUY A 486

Will Pentium prices fall as far and as fast?

Notice the domino effect that occurred in PC pricing after the 486DX price decreased by half in 1990. If Pentium prices undergo a similar drop, 486s will be even more affordable.



SOURCE: DATAQUEST

iness

competitive edge

INSIDE...

- Low-Cost PCs 134
- High-Performance PCs 138
- 386 Notebooks 146
- 486 Notebooks 150

comes at a price, though: These machines cost as much as $4,350.

Bargain Basement: 386 Notebooks The one system in which a 386 CPU still makes fiscal sense is a low-cost notebook. Best for occasional travelers and light Windows users, they typically cost less than $2,400 for a 386SX CPU, a 60MB hard disk, and two serial ports. It's the minimum configuration we recommend: Windows will run on it but not very well. Look for easy-access connectors, a conveniently placed floppy drive, and the four arrow keys arranged in an inverted T layout.

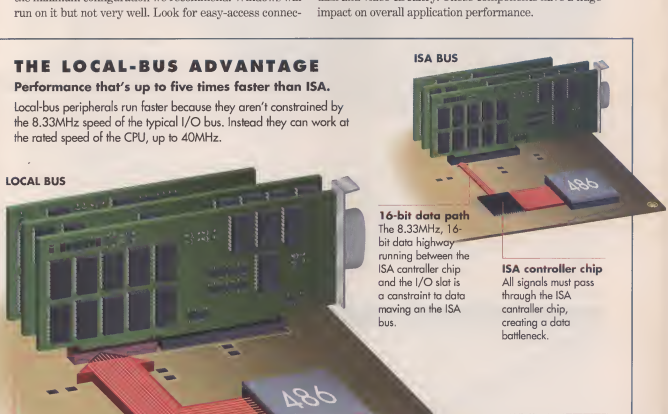
Power Boosters

A PC's speed is limited by its slowest component. That's why you must consider the type and amount of memory and external processor cache, as well as the type of hard disk and video circuitry. These components have a huge impact on overall application performance.

THE LOCAL-BUS ADVANTAGE

Performance that's up to five times faster than ISA.

Local-bus peripherals run faster because they aren't constrained by the 8.33MHz speed of the typical I/O bus. Instead they can work at the rated speed of the CPU, up to 40MHz.



16-bit data path The 8.33MHz, 16-bit data highway running between the ISA cantroller chip and the I/O slat is a constraint ta data maving an the ISA bus.

ISA controller chip All signals must pass thraugh the ISA cantroller chip, creating a data battleneck.

Local-bus I/O slots PC signals have direct access to local-bus I/O slats and adapter cards withaut having to ga thraugh the ISA cantroller bottleneck.

32-bit data path The local bus's wider data path—usually 32 bits—daubles the amaunt af data that can mave simultaneausly thraugh it.

CPU The speed af the lacal bus depends an the micraprocessar, up ta 40MHz, allawing data ta mave amang PC campanents up ta five times faster than in an ISA bus.

ILLUSTRATION BY TIMOTHY EDWARD SOWERS

First, you need a fast, well-designed CPU-memory system. The goal is to avoid wait states—situations that make the CPU wait a cycle or two for the data it needs from memory. Wait states kill performance even on the best-configured system.

A great way to reduce wait states is to get a healthy amount of external processor cache. Even though the 486DX, 486DX2, and 486SX CPUs include 8K of cache, you still need a big hunk of external, processor cache memory to accelerate data moving between system memory and the CPU's internal cache and registers.

How much is enough? We recommend at least 64K for 20MHz 486 or slower systems, 128K for faster 486SX CPUs, and 256K for the 486DX and 486DX2 groups. If the system lets you expand to 512K, go for it.

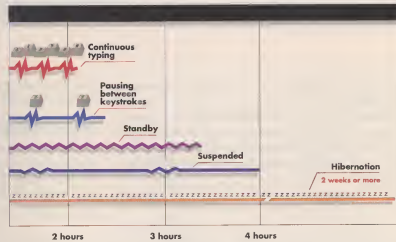
The type of cache also affects performance. A direct-mapped, write-through cache is the least expensive, and it's fine for DOS and Windows machines. But more complicated operating systems thrive on more expensive and advanced cache types. If you use or plan to use a 32-bit multitasking system, look for a two- or four-way set-associative cache and a write-back cache.

Memory is also key. Our recommendation for a basic Windows configuration is at least 8MB. And for an OS/2 or Windows NT setup, specify 16MB or more. Make sure the system lets you expand memory up to at least 16MB—or for server applications, 32MB.

BATTERIES KEEP ON GOING

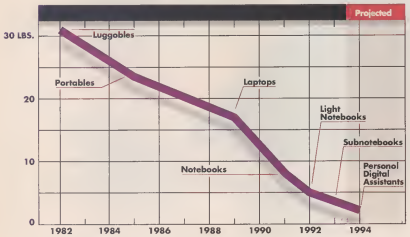
Notebook power-saving benefits.

Battery life is extended progressively when you pause between keystrokes, activate standby mode by not using the keyboard for a preset interval, and activate suspend mode after a longer period. Best of all is hybernation mode.



Your system may incorporate page-mode or interleaved RAM—the fastest systems tend to combine both. But because SIMMs can work in either type of memory bay, a more important concern should be getting enough sockets: One 32-bit bank typically lets you plug in four SIMMs. Worry less about memory speed: A competent system designer will spec memory that's the right speed to match the system's CPU. When upgrading memory, use SIMMs rated at the same speed as your RAM.

Once you've got your CPU, cache, and memory in order, the quickest route to improved Windows performance is local bus—a method of plugging video, hard disk, or other I/O controller circuitry into the system so that it can run at up to 40MHz, instead of the 8MHz that typical ISA



GOING MOBILE

The incredible shrinking PC makes portability a reality.

Fortune 500 companies aren't the only ones who've downsized over the past decade. Portable PCs have also became leaner and more efficient at a rapid rate.

THE PERFECT NOTEBOOK

The well-equipped portable doesn't compromise.

The perfect notebook has a fast 486 CPU and an active-matrix color display. It offers as much upgradability as a desktop PC, including a removable hard drive and ram for extra RAM.



PHOTO BY FRED BEST/DESIGN, PHOTOILLUSTRATION BY WILLIAM HOPKINS/DRAWING BY DAN CLARK

slots are limited to (see "The Local-Bus Advantage," page 131). A system with a graphics card in a local-bus socket, a hard disk controller on the local bus, or both runs Windows significantly faster than one without.

Some PCs offer proprietary local-bus connections. The rest of them support the closest thing to a local-bus standard that we have—VESA. Systems that support VESA's VL-Bus specification have one or more 32-bit slots where you can install VL-Bus label adapter cards. But you'll get a better deal buying a system when hard disk or graphics local-bus circuitry is already installed.

Designing Systems

Whether you're buying a desktop or a notebook, you want a PC that's speedy and easy to use and upgrade. Other considerations include the keyboard feel, the location of switches and knobs, and the tiltability of the monitor.

We recommend systems designed for easy upgrades so that you can reach all the SIMM sockets without removing any components and pop out the hard disk and floppy drives by removing a few screws. Other features to look for are a flash-memory BIOS, and a zero-insertion-force (ZIF) socket for the CPU. Systems that include a ZIF CPU socket (and the option to switch clock speed) let you pop out the 486 and replace it with any other type of 486 CPU. One caveat, though: Don't pay extra for the "Pentium ready" upgrade sockets that some 486 PCs now offer. And if your system includes one, insist on a guarantee that it will work with the so-called P24T Pentium upgrade chip.

When you're buying PCs, remember that you're the expert. Insist on testing the software your company uses and feel free to demand a lot. This is your budget, and your business needs PCs that make the most of it.

LOW-COST PCs

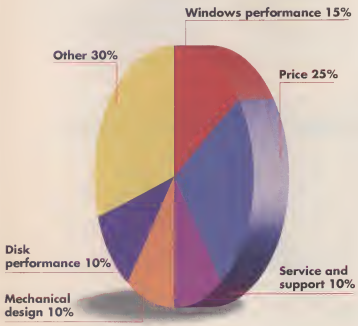
Windows and DOS power at down-to-earth prices

If you like a bargain, you'll love the winning systems in the low-cost 486 desktop PCs category. Based on 486SX or DX CPUs, these systems have enough power to handle most DOS- and Windows-based business applications. Most are upgradable, too, so when hardware standards change you'll still have options. Whether you buy one or a hundred, these workhorses will save you plenty.

To qualify, these PCs had to include everything needed for fast, affordable Windows computing: a 486DX or SX CPU running at up to 33MHz, at least 4MB of RAM, a 100MB hard disk, a 14-inch Super VGA monitor, and three free slots after video and the hard disk are configured. Of the 30 systems that met these criteria, only 11 survived our rigorous performance, design, and service testing. For the money, you won't find any faster or more reliable systems.

DECIDING FACTORS

Price is both the top priority and the bottom line for a low-cost PC, but don't overlook performance.



Factors and Weights

Price is the key factor when considering low-cost desktop systems, so we've weighted price at 25 percent of each system's total score. **Windows performance** is weighted at 15 percent and represents a system's ability to handle complex, real-world tasks in three different Windows applications. **Video performance**, at 10 percent, measures how quickly each system can perform character-based DOS graphics tests. Similarly, **disk performance** rates at 10 percent, and the combined scores of each system's **CPU and memory performance** tests account for another 10 percent of the total.

Mechanical design (10 percent) gauges how well designed a system is, and how easy it is to upgrade. Because you expect business systems to last from three to five years, you want to buy from a company that provides great **service and support**—a factor that constitutes 10 percent of the total score. Finally, **ease of installation** and the quality of the **documentation** are worth 5 percent each.

How We Tested

To test the machines' Windows performance, ZD Labs subjected each system to three applications tests. In Excel 4.0, we timed how long it took the PC to execute complex charting, graphics, and calculation tasks. In Word for Windows 2.0, we measured the time needed to complete a complicated macro involving scrolling, cutting, pasting, and spell-checking. Using CorelDraw 2.0, we put the systems through tough rendering tests. Finally, technicians used ZD Bench 2.01 to gauge the computers' DOS-based video, raw hard disk, and CPU and memory capabilities.

ZD Labs physically inspected each system's mechanical design to determine the type and quality of circuitry inside. We awarded points for fast hard disk subsystems, high-performance graphics circuitry, extra 16-bit slots, any 32-bit slots, an upgradable CPU, and a flash-memory BIOS. Systems lost points for installation problems, noisy drives, overheating, or designs that make upgrading the hard disk and memory unwieldy. We also evaluated the quality and comprehensiveness of each vendor's service and support plan.

PC/COMPUTING DECISION MAKER

How to buy the low-cost PC that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Windows performance	Disk performance	CPU/memory performance	MicroFlex 486SX/33
		Mechanical design	Poly486SX-33VA
	Price	Mechanical design	Poly486SX-33VA
		Disk performance	MicroFlex 486SX/33
Price	Service and support	Windows performance	Dell System 433s/L
		Disk performance	Superset 600/433s
	CPU/memory performance	Disk performance	MicroFlex 486SX/33
		Mechanical design	Leader Coche 486/33
Service and support	Windows performance	Mechanical design	AST Bravo 4/33s
		Price	Dell System 433s/L
	Mechanical design	CPU/memory performance	AST Bravo 4/33s
		Price	Dell System 433s/L

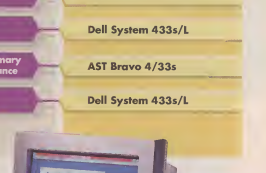
PC Computing BEST

LOW-COST PC

Poly486SX-33VA scores with local bus.

The $1,700 33MHz 486SX-33VA was the only system we tested with two peripherals on the VESA local bus: a fast IDE controller for the 120MB Quantum ProDrive LPS, and an S3-based Orchid Fahrenheit graphics card. Not surprisingly, the combination turned out consistently excellent performance on our Windows application tests. The Polywell fared just as well on our mechanical design evaluations. All five drive bays are front accessible—this makes hard disk upgrading a breeze.

Poly486SX-33VA • Polywell Computers • 61-C Airport Blvd., South San Francisco, CA 94080 • (800) 999-1278, (415) 583-7222 • $1,700



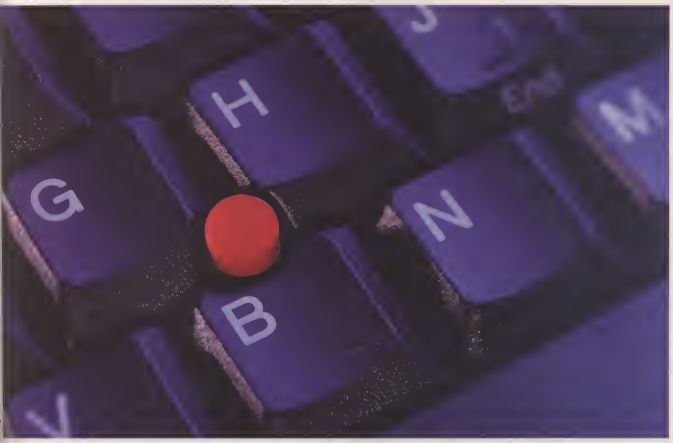
BEST SYSTEMS

LOW-COST PCs

Rank	Product	Pros and Cons	Price * 25%	Windows performance 15%	CPU/memory performance 10%	Disk performance 10%	Mechanical design 10%	Service and support 10%	Video performance 5%	Documentation 5%	Ease of installation 5%	Total Score
1 PC Magazine BEST	**Poly486SX-33VA** Palywell Camputers 61-C Airport Blvd. S. San Francisco, CA 94080 (800) 999-1278 $1,700	**Pros:** Best Windows performance thanks to local-bus graphics and IDE controllers; six free slots when fully configured. **Cons:** No free onsite service.	9.1	9.8	9.1	8.5	9.2	8.8	9.2	10.0	10.0	**92.3**
2	**Dell System 433s/L** Dell Computer Carp. 9505 Arbaretum Blvd. Austin, TX 78759-7299 (800) 289-3355 $1,749	**Pros:** A top service-and-support package; superfast S3 graphics chip set is easy to upgrade. **Cons:** Only three slots and only 128K of processor cache.	9.0	9.6	9.3	8.2	8.8	9.6	9.3	8.7	8.3	**90.6**
3	**ALR Flyer SD32 4/33s** Advanced Logic Research 9401 Jeronima Rd. Irvine, CA 92718 (800) 4444257 $1,748	**Pros:** Above-average disk performance from 169MB Western Digital Caviar IDE drive. **Cons:** Pain-vanilla graphics circuitry and no external cache made Windows apps lag.	9.0	8.9	8.6	8.8	8.8	8.8	8.5	10.0	8.3	**88.5**
3	**MicroFlex 486SX/33** Micro Express 1801 Carnegie Ave. Santa Ana, CA 92705 (800) 989-9900 $1,599	**Pros:** Great price for its configuration; 1MB caching controller earned top disk scores. **Cons:** Incomplete, photocopied documenation; poor character-based graphics performance.	9.3	9.5	9.2	10.0	7.7	8.1	8.0	7.6	8.3	**88.5**
5	**Leader Coche 486/33** PC Brand 405 Science Dr. Moorpark, CA 93021 (800) 722-7263 $1,695	**Pros:** 486DX PC includes 8MB of RAM, a 64K cache, and 5 free slots. **Cons:** Cheap interlaced monitor; sluggish 107MB Seagate IDE drive.	9.1	8.8	10.0	7.9	8.5	8.8	8.4	9.3	8.3	**88.4**
6	**Insight 486SX-25I** Insight Distribution Network 1912 West Fourth St. Tempe, AZ 85281 (800) 927-7848 $1,499	**Pros:** Lawest price; local-bus S3- Powergraph graphics card; 212MB IDE drive; ZIF CPU socket. **Cons:** Unwieldy memory and hard disk upgrades.	9.5	7.7	7.7	8.8	10.0	7.7	8.4	8.7	10.0	**87.3**
7	**Ariel 486 SX33 VLB** Ariel Design 145 Webster St. Hanover, MA 02339 (800) 942-7435 $2,095	**Pros:** Free VL-Bus socket; memory expandable ta 64MB; best character-based graphics performance. **Cons:** Expensive; slow Windows performance.	8.2	9.1	9.3	8.4	9.2	8.8	9.3	7.6	8.3	**87.1**
8	**Superset 600/433s** Twinhead Carp. 1537 Centre Pointe Dr. Milpitas, CA 95035 (800) 995-8946 $1,580	**Pros:** Good price; great service and support package. **Cons:** Plain-vanilla graphics and Maxtar IDE drive mean poor Windows performance; difficult hard disk upgrade.	9.3	8.1	8.8	8.4	8.5	9.0	8.3	8.3	8.3	**86.7**
9	**AST Bravo 4/33s** AST Research 16215 Alton Pkwy. Irvine, CA 92718 (800) 876-4278 $2,245	**Pros:** Excellent internal design; ZIF CPU socket; memory expandable to 64MB; easy memary and storage upgrades. **Cons:** Expensive; plain VGA circuitry.	7.8	8.9	9.3	8.4	9.2	10.0	8.4	8.3	8.3	**86.5**
10	**Tandy 433 SX** Tandy Carp. 1800 One Tandy Center Fart Warth, TX 76102 (817) 390-3011 $1,804	**Pros:** Graphics suppart up to 1,280-by-1,024 resolution; includes America Online. **Cons:** Adding expansion cards is unwieldy; hard disk access is blocked.	8.8	8.8	8.9	8.1	9.6	7.7	8.4	8.0	8.8	**86.3**
11	**PB 400** Packard Bell Electronics 9425 Canaga Ave. Chatsworth, CA 91311 (800) 733-5858 $1,699	**Pros:** Low price includes 233MB drive; chip set turns in good Windows performance. **Cons:** Memary can expand to only 8MB ar 20MB; documentation is sporse.	9.1	8.3	7.8	8.9	8.5	9.2	7.9	8.7	8.3	**86.0**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

So hot, we had to make it red.



There it is, nestled among the keys like a jewel in a perfect setting. It's the TrackPoint™ II pointing device, and only the new IBM ThinkPads™ have it. To call it a mouse would be woefully inadequate. For where a mouse merely rolls, TrackPoint II dances. An almost imperceptible move of your fingertip controls it; merely touch the rubberized little button and *think* where on the screen you want to go. It responds as though it's read your mind. And since TrackPoint II is strategically located so that neither hand need ever leave the keyboard, using a ThinkPad is as easy as it gets. Hands down.

PCComputing '92 MVP WINNER



For more information or an IBM dealer near you, you can call **1 800 772-2227**. In Canada, call **1 800 465-7999**.

Introducing

ThinkPad

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IBM

HIGH-PERFORMANCE PCs

High-end systems deliver heavy-duty PC power

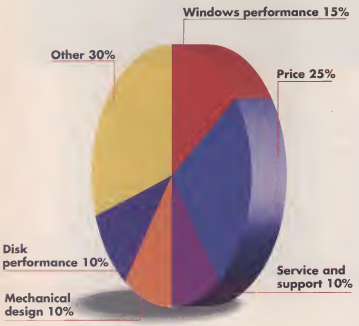
Make no mistake—these systems are powerhouses.

The high-performance desktop winners will make short work of your most intensive computing tasks. Want to see Windows fly? With their 486DX processors, plenty of RAM, and high-end video, these systems are the ideal platform for today's resource-hungry operating environments and applications.

The systems that qualified for this category are powered by a 66MHz 486DX2 or a 50MHz 486DX processor and have at least 8MB of RAM, a 256K external processor cache, and a 100MB or larger IDE hard drive. Their displays support at least 1,024-by-768 resolution. Since you'll also want plenty of room to expand, we required that each system have at least four free slots after any video and hard drive controllers were installed. The 25 systems that met these criteria were subjected to a merciless suite of performance and design tests. When the smoke cleared, only 8 systems were left standing.

DECIDING FACTORS

Performance scores for Windows, disk, and video constitute more than a third of the total score for these systems.



Factors and Weights

Even though they cost more than run-of-the-mill systems, you still want the most computing power you can get for your dollar. **Price,** therefore, carries the highest weight in this category, contributing 25 percent of each system's total score. **Windows performance** is next in importance at 15 percent. Because you want a well-built system that isn't difficult to upgrade, **mechanical design** contributes another 10 percent.

Each system's **video performance,** as measured by the ZD Bench 2.0 video benchmark, accounts for 10 percent of its total score. **Disk performance,** a key factor for running disk-intensive applications, is also worth 10 percent, as is each system's combined PC Bench **CPU and memory performance** scores. Because you want accessible, responsive customer support when something goes wrong, **service and support** accounts for 10 percent of the overall score. Finally, ease **of installation** and quality of **documentation** are worth 5 percent each.

How We Tested

ZD Labs used three Windows application tests. Technicians timed how long it took the PC to execute a complex set of charting, graphics, and calculation tasks in Microsoft Excel 4.0. They measured the amount of time it took to complete a complicated Microsoft Word for Windows 2.0 macro that involved scrolling, cutting, pasting, and spell-checking. Finally, they put the PC through a difficult rendering task in CorelDraw 2.0. To arrive at an overall measure of a system's ability to handle real-world application tasks, the three application test times were added together. Finally, ZD Bench 2.0 evaluated the computers' raw video, disk, CPU, and memory performance.

We inspected each system to determine the quality of its mechanical design. Systems got points for fast hard disk subsystems, high-performance graphics circuitry, extra 16-bit slots, any 32-bit slots, an upgradable CPU, and a flash-memory BIOS. Systems lost points for installation problems, noisy drives, overheating, and designs that were difficult to upgrade.

PC/COMPUTING DECISION MAKER

How to buy the high-performance PC that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Windows performance	Mechanical design	CPU/memory performance	Gateway 4DX-66V
		Disk performance	Gateway 4DX-66V
	Price	Service and support	AcerPower 486e DX2/66
		Disk performance	Amax 486DX Power Station
Price	CPU/memory performance	Windows performance	Amax 486DX Power Station
		Mechanical design	Dell System 466/M
	Video performance	Service and support	ME 486-VL/DX2/66
		Disk performance	ME 486-VL/DX2/66
Service and support	Price	Windows performance	Advantage Plus 486DX2/66
		CPU/memory performance	Advantage Plus 486DX2/66
	Documentation	Disk performance	Hyundai 466D2
		Mechanical design	Hyundai 466D2

PC Computing BEST

HIGH-PERFORMANCE PC

You Can't Touch This! Gateway's 4DX2-66V.

The Gateway turned in some of the best Windaws, video, and CPU and memory performance scores of all the machines we tested. Its 66MHz Intel 486DX2 processar makes short work of the taughest jabs. Graphics-intensive tasks are na problem far its fast ATI Ultra PraVesa lacal-bus video card. And with 8MB af memory and a 340MB Western Digital Caviar 2340 hard drive, the Gateway can handle a host af business applications. The Gateway's second VESA slat, seven free ISA slats, and spaciaus desktap case give yau plenty af raam ta graw.



Gateway 4DX2-66V • Gateway 2000 • 610 Gateway Dr., P.O. Box 2000, North Sioux City, SD 57049 • (800) 846-2000, (605) 232-2000 • $2,995

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Big, roomy screens—15" for our 3FGe and 4FGe, 17" for our 5FGe*—provide plenty of space for Windows and multimedia video. Higher refresh rates deliver even crisper, steadier images. They also offer broader compatibility with PC and Mac® platforms, including IBM®'s XGA®-2 standard. Compliance with strict Swedish MPR II emissions guidelines. Even, a new 3-year limited warranty.



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NEC

Circle 202 on reader service card.

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All
day
Every
DAY

BEST SYSTEMS

HIGH PERFORMANCE PCS

Rank	Product	Pros and Cons	Price 25%*	Windows performance 15%	CPU/memory performance 10%	Disk performance 10%	Mechanical design 10%	Service and support 10%	Video performance 10%	Documentation 5%	Ease of installation 5%	Total Score
1 BEST	**Gateway 4DX2-66V** Gateway 2000 610 Gateway Dr. P.O. Box 2000 North Sioux City, SD 57049 (800) 846-2000 $2,995	**Pros:** Very fast local-bus ATI video card; excellent Windows performance; easy memory and hard drive upgrades; roomy case. **Cons:** 14-inch manitor only; slow 8250 UART.	8.9	9.8	9.5	8.6	10.0	8.8	9.7	9.6	8.3	**92.5**
2	**ME 486-VL/DX2/66** Micro Express 1801 Carnegie Ave. Santa Ana, CA 92705 (800) 989-9900 (714) 852-1400 $2,799	**Pros:** Windows performance tied far second place; great price; fast Promise caching disk controller. **Cons:** Wires and IDE card block access to SIMMs, impeding memory upgrades.	9.8	9.8	8.7	9.7	8.2	8.3	9.4	8.6	8.3	**92.0**
3	**Dell System 466/M** Dell Computer Corp. 9505 Arboretum Blvd. Austin, TX 78759-7299 (800) 289-3355 (512) 338-4400 $3,599	**Pros:** Top CPU and memory scores; free onsite service plan boosted by 24-hour 800 number, BBS, and faxback program; fast 16550 UART. **Cons:** Small, law-performance 122MB hard drive.	8.8	9.7	10.0	8.1	9.5	9.5	9.2	7.9	8.3	**91.0**
4	**Amax 486DX Power Station** Amax Engineering Corp. 3288 Laurelview Court Fremont, CA 94538 (800) 800-6328 (510) 651-8886 $2,349	**Pros:** Superfast local-bus caching IDE disk controller; large 380-watt power supply; easily upgradable memory and hard disk; low price. **Cons:** Slow video performance; 14-inch manitor only.	9.7	9.6	8.5	10.0	8.7	7.4	7.9	7.9	8.3	**89.3**
5	**Hyundai 466D2** Hyundai Electronics America 166 Baypointe Pkwy. San Jose, CA 95134 (800) 627-7978 (408) 473-9200 $3,365	**Pros:** Well-designed case with quick-release hard drive; excellent service program. **Cons:** Below-average CPU/memory performance; 14-inch manitor only.	8.4	9.2	8.0	8.6	9.2	9.5	9.3	9.3	9.6	**88.9**
6	**SST 486DX2-66VLB** Sirius Systems Technology 4344 Young St. Pasadena, TX 77504 (800) 424-0724 (713) 946-0724 $2,995	**Pros:** $2,995 price; very good Windows performance. **Cons:** Hard drive located underneath power supply; SIMMs difficult to access and remove; noisy SCSI hard drive; poorly documented.	9.5	9.6	8.6	7.9	7.5	8.6	9.0	8.2	8.3	**88.0**
7	**AcerPower 486e DX2/66** Acer America Corp. 2641 Orchard Parkway San Jose, CA 95134 (800) 733-2237 (408) 432-6200 $3,699	**Pros:** Best Windows performance among winners; service program includes free onsite service, 800 number. **Cons:** Weak disk performance; difficult memory upgrade; proprietary local-bus slot.	8.6	9.9	8.4	8.1	8.7	9.1	9.0	7.9	8.3	**87.8**
8	**AST Advantage Plus 486 DX2/66** AST Research 16215 Alton Pkwy. Irvine, CA 92718 (800) 876-4278 $3,499	**Pros:** Excellent service and support program; good CPU/memory performance. **Cons:** Poor Windows performance; cables and power supply impede access to SIMMs; small minitower case.	8.9	8.6	9.1	8.6	8.0	10.0	8.4	7.9	8.3	**87.4**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.



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386 NOTEBOOKS

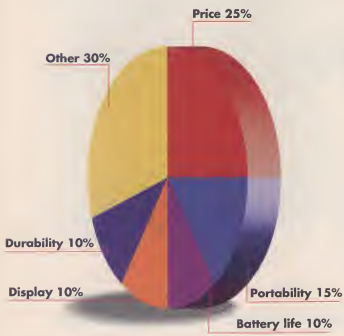
Taking Windows with you is easy and affordable

Remember the days when propping your notebook PC on an airplane tray table elicited stares and curious comments? Today it doesn't even rate a double-take. The rise in notebook power and refinement—and, of course, the plunge in prices—has made the technology ubiquitous among travelers. As our research for the *PC/Computing* 200 proved, you can find a superb Windows-capable notebook for well under $2,500.

Minimum requirements for inclusion in our 386 notebook category included a 386 CPU running at 25MHz or faster, 4MB of RAM, a 60MB hard drive, two serial ports (one of which could be a PS/2-style mouse and/or keyboard port), and a price under $2,500. There were no measurement requirements that the notebooks had to meet, but they had to weigh under 8 pounds.

DECIDING FACTORS

Low price was key, but winners also scored high for portability, durability, and battery life.



Factors and Weights

The primary criterion for notebooks in this category is **price,** which makes up 25 percent of each product's final score. **Portability,** which takes into account both size and weight, comes next in importance at 15 percent.

Durability, battery life, and the size and quality of the **display** each contribute 10 percent to the final score. We arrived at a score for durability by examining design features, such as the sturdiness of the display hinge and port covers, and by putting each notebook through a drop test. Scores for battery life are based on the rundown test results with power-management features turned off, and on ZD Labs' ZDigit test, which reflects actual battery life with power-management features engaged. Scores for notebook displays give equal weight to brightness, contrast, size, and quality.

Ergonomics, ports and expansion, performance, service and support, documentation, and **ease of installation** each account for 5 percent of the total score. Ergonomics includes keyboard layout and response, the positioning of ports and disk drives, and whether you can swap batteries without powering down. High scores for ports and expansion go to systems with removable hard drives, upgradable CPUs, flash BIOS, and docking stations. Performance ratings reflect both DOS and Windows benchmark tests and real-world applications tests.

How We Tested

ZD Labs weighed and measured each notebook, its battery, and its recharger. We depleted batteries completely of charge using ZD Bench 2.01's Battery Drain test, then recharged them, repeating the process three times. We then ran the ZDigit test, which, at programmed intervals, automatically presses a key, preventing the machine from slipping into suspend mode. It's a better indicator of real-world battery life.

To gauge performance, we ran the ZD Bench and WinBench tests as well as WinTest, which evaluates notebooks in real-world applications tests using Word for Windows and Excel. We then measured the brightness and contrast with ZD Labs' luminance meter. Display quality was evaluated separately by a jury of reviewers. Scores for durability were based on the condition of each notebook after it had fallen three feet while it was switched on.

PC/COMPUTING DECISION MAKER

How to buy the 386 notebook that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Price	Portability	Performance	Dell Dimension NL25
		Ergonomics	CAF AquaLite-II
	Battery life	Performance	Jetta Jetbook
		Ergonomics	CAF AquaLite-II
Portability	Price	Performance	AST PowerExec EL
		Ergonomics	CAF AquaLite-II
	Battery life	Performance	Dell 325N
		Ergonomics	CAF AquaLite-II
Battery life	Price	Ergonomics	Dell 325N
		Performance	Jetta Jetbook
	Portability	Ergonomics	Dell Dimension NL25
		Performance	Dell 325N

PC Computing BEST

386 NOTEBOOK

AST's PowerExec EL takes a giant step forward.

The $1,745 AST PowerExec EL brings with it features found in machines that cost twice as much. The 386SL/25 PowerExec EL weighs just over six pounds and features a 9.5-inch screen that displays 64 levels of gray. It also comes with flash BIOS, a removable hard drive, a PCMCIA Type II slot, a display that you can upgrade to passive- or active-matrix color, and a superb keyboard. Dollar for dollar, the PowerExec EL is one of the most expandable—and practical—Windows portables you'll find.

PowerExec EL • AST Research • 16215 Alton Pkwy. • P.O. Box 19658 • Irvine, CA 92718-9658 • (800) 876-4278 • $1,745



BEST SYSTEMS

386 NOTEBOOKS

Rank	Product	Pros and Cons	Price* 25%	Portability 15%	Battery life 10%	Display 10%	Durability 10%	Documentation 5%	Ease of installation 5%	Ergonomics 5%	Performance 5%	Ports and expansion 5%	Service and support 5%	Total Score
1 BEST	**PowerExec EL** AST Research 16215 Alton Pkwy. Irvine, CA 92718 (800) 87-64278 (714) 727-4141 $1,745	**Pros:** Feature-packed; eminently upgradable; excellent keyboard. **Cons:** Performance not the fastest.	9.4	9.0	8.4	9.0	8.8	8.9	10.0	8.6	7.6	9.8	8.6	**90.0**
2	**Dell Dimension NL25** Dell Computer Corp. 9505 Arboretum Blvd. Austin, TX 78759-7299 (800) 289-3355 (512) 338-4400 $1,699	**Pros:** Solidly built; good price and technical service. **Cons:** Mediocre battery life.	9.6	8.8	8.2	9.1	9.3	8.9	10.0	8.2	7.6	8.2	8.9	**89.7**
3	**Tandy 3830SL** Tandy Corp. One Tandy Center Fort Worth, TX 76102 (817) 390-3011 $1,888	**Pros:** Bright; beautiful display; good construction. **Cons:** Low expandability; poor keyboard layout.	8.9	8.8	8.5	9.4	9.7	8.3	10.0	9.8	8.3	8.2	8.2	**89.5**
4	**Jetbook** Jetto Int'l 51 Stouts Lane, Suite 3 Monmouth Junction, NJ 08852 (908) 329-9651 $1,775	**Pros:** Amazing battery life; excellent performance under both DOS and Windows. **Cons:** Somewhat hefty.	9.3	7.8	9.7	9.2	8.8	8.3	10.0	7.9	9.1	8.2	9.1	**89.0**
5	**Dell 325N** Dell Computer Corp. 9505 Arboretum Blvd. Austin, TX 78759-7299 (800) 289-3355 (512) 338-4400 $1,799	**Pros:** Solid battery life; bright, large display. **Cons:** Display died in drop tests.	9.2	8.6	9.1	8.9	6.8	10.0	10.0	8.8	8.6	8.4	8.9	**88.1**
5	**AquaLite-II** CAF Technology 1315 Johnson Dr. City of Industry, CA 91745 (818) 369-3690 $1,633	**Pros:** Light weight; good design and construction. **Cons:** Poor performer.	9.9	9.8	8.5	9.2	7.3	7.7	10.0	9.2	4.4	8.2	7.7	**88.1**
7	**ThinkPad 300** IBM Personal Computer Route 100, Bldg. 3 Somers, NY 10589 (800) 772-2227 (914) 766-1900 $1,999	**Pros:** Superb construction; good display. **Cons:** Relatively expensive.	8.5	8.5	8.8	9.0	10.0	8.9	10.0	8.8	7.9	8.4	7.7	**87.7**
8	**DECpc 325SL** Digital Equipment Corp. 50 Nagog Park Acton, MA 01720 (800) 722-9332 $2,399	**Pros:** Bright; beautiful display; supports PCMCIA; good keyboard layout. **Cons:** Expensive.	7.0	8.8	8.8	8.9	9.5	8.3	10.0	9.6	9.1	10.0	8.2	**85.5**

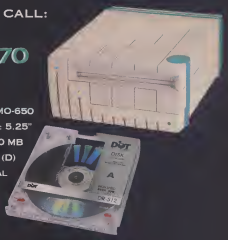
* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE

STORAGE PRODUCT OF THE YEAR



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PC COMPUTING

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486 NOTEBOOKS

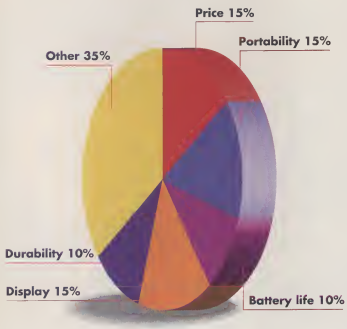
Desktop power in a go-anywhere package

Given the amount of time that you spend with your PC, why settle for less power, capability, and refinement on the road than in the office? Take a look at the latest generation of high-performance notebooks, and you'll glimpse the confluence of full desktop power and civilized portability.

For the high-performance notebook category in the *PC/Computing* 200, we considered machines with monochrome, passive-matrix color, and active-matrix color displays that run a 20MHz or faster 486 CPU. The notebooks also had to feature at least a 120MB hard drive, 4MB of memory, and two serial ports, one of which could be a PS/2-style mouse and/or keyboard port. We started out with 29 contenders; only 9 made it onto our winners list.

DECIDING FACTORS

The best notebooks you can buy strike the right balance between price, performance, and portability.



Factors and Weights

Portability, price, and **display** each account for 15 percent of a notebook's total score. Portability scores are based on the machine's size and its weight with a battery. Displays are scored on the basis of objective criteria—their size, brightness, and contrast—as well as by their overall quality as determined by a jury of technicians.

Durability, battery life, and **performance** each make up 10 percent of a notebook's score. ZD Labs measured durability with a drop test, but this factor also takes into account design elements such as the quality of the hinge, port covers, and door latches. Battery life scores are derived from ZD Bench 2.01's Battery Drain test and the ZDigit test, which more accurately reflects real-world battery charge. Scores for performance reflect component-specific performance and application throughput.

Ergonomics, ports and expansion, service and **support, documentation,** and **ease of installation** contribute 5 percent each to the total score. Ergonomics includes the layout and response of the keyboard, whether you can "hot swap" batteries without powering the system down, whether a battery gauge is included, the quality of the pointing device if included, and other design details. For the ports and expansion factor, high points go to flash BIOSs, removable hard drives, upgradable CPUs, and the availability of docking stations.

How We Tested

ZD Labs weighed and then measured each notebook, its battery, and its recharger. We depleted batteries using the ZD Bench 2.01's Battery Drain test, then recharged them, repeating the process three times. We then ran the ZDigit test, which at programmed intervals presses a key, preventing the machine from slipping into suspend mode.

ZD Labs evaluated each notebook's performance using its ZD Bench 2.01 and WinBench tests as well as WinTest, which performs real-world applications tests using Microsoft Word for Windows and Microsoft Excel. We measured the brightness and contrast of each notebook display using ZD Labs' luminance meter; display quality was also evaluated separately by a jury of reviewers. Finally, in the durability test, we dropped each notebook while its power was on from a height of 3½ feet and then assessed its condition.

PC/COMPUTING DECISION MAKER

How to buy the 486 notebook that's best for your business.

1. Choose the factar that's mast impartant to you.	2. Choose the next most impartant factar.	3. What else is impartant?	4. For your needs, the best product to buy is...
Price	Partability	Display	Twinhead Slimnote 4DX/33T
		Durability	Z-Sport 420S
	Battery life	Durability	Narthgate ZXPortable
		Ergonamics	Z-Note 425Ln
Portability	Price	Durability	Narthgate ZXPartable
		Display	Z-Spart 420S
	Battery life	Durability	Gateway Nomad 450DXL
		Display	Gateway Nomad 450DXL
Battery life	Partability	Durability	Gateway Nomad 450DXL
		Display	Z-Note 425Ln
	Price	Durability	NoteMaster 486SLC
		Display	Z-Note 425Ln



PC Computing BEST

486 NOTEBOOK

Zenith's Z-Sport 420S is a 6-pound heavyweight.

Any notebaak manufacturer can pack full desktap capability inta naminally portable but pricey PCs. Naw Zenith Data System's Z-Spart 420S breaks the weight and cast barriers. The sauped-up system we tested lists far $3,499, but prices actually start at a law $1,999 and the 6-paund 420S packs a 20MHz 486SX CPU in a box that measures anly 11 by 8.5 by 1.95 inches. A bright, beautiful 9.75-inch manachrame display capable af 64 levels af gray and a lang battery life make it ane of the best bargains around.

Z-Sport 420S • Zenith Data Systems • 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089 • (800) 553-0331, (708) 808-5000 • $1,999

BEST SYSTEMS

486 NOTEBOOKS

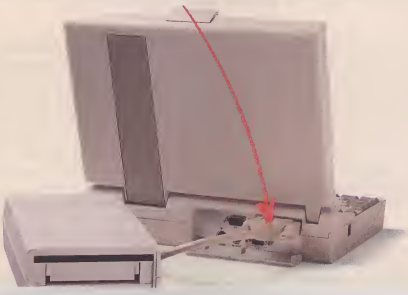
Rank	Product	Pros and Cons	Display 15%*	Portability 15%	Price 15%	Battery life 10%	Durability 10%	Performance 10%	Documentation 5%	Ease of installation 5%	Ergonomics 5%	Ports and expansion 5%	Service and support 5%	Total Score
1	**Z-Sport 420S** Zenith Data Systems 2150 E. Lake Cook Rd. Buffalo Grove, IL 60089 (800) 553-0331 (708) 808-5000 $1,999	**Pros:** Great value; light weight; excellent keyboard layout and response. **Cons:** None.	8.3	9.1	9.9	8.5	10.0	8.6	10.0	10.0	8.5	8.5	8.4	**90.8**
2	**Nomad 450DXL** Gateway 2000 610 Gateway Dr. North Sioux, SD 57049 (800) 846-2000 (605) 232-2000 $3,295	**Pros:** Solid battery life; blisteringly fast performance. **Cons:** Somewhat expensive; undersized cursor and function keys; ghost-ridden display.	8.4	9.1	8.0	9.3	10.0	10.0	9.0	10.0	8.2	8.4	8.4	**89.6**
3	**Z-Note 425Ln** Zenith Data Systems 2150 E. Lake Cook Rd. Buffalo Grove, IL 60089 (800) 553-0331 (708) 808-5000 $2,599	**Pros:** Great battery life; fast performance in both DOS and Windows applications. **Cons:** Slightly large.	8.3	8.8	9.0	9.7	8.6	9.2	10.0	10.0	8.7	8.5	8.4	**89.5**
4	**ZXPortable** Northgate 7075 Flying Cloud Dr. Eden Prairie, MN 55344 (800) 548-1993 (612) 943-8181 $1,999	**Pros:** Light weight; well-constructed hinges and keyboard; display mounts; good price. **Cons:** Mediocre performance.	8.0	9.1	9.9	8.6	10.0	8.2	8.0	10.0	9.0	8.3	8.8	**89.4**
5	**ThinkPad 700C** IBM Personal Computer Route 100, Bldg. 3 Somers, NY 10589 (800) 772-2777 (914) 766-1900 $4,350	**Pros:** Magnificent display; excellent upgradability; superb keyboard. **Cons:** Heft and price.	9.9	7.6	6.5	8.5	10.0	9.0	10.0	10.0	10.0	9.0	9.5	**87.8**
6	**Slimnote 4DX/33T** Twinhead Corp. 1537 Centre Pointe Dr. Milpitas, CA 95035 (800) 995-8946 (408) 945-0808 $2,199	**Pros:** Gorgeous display; petite size; good price. **Cons:** Limited battery life; fragile display.	9.6	9.0	9.6	8.3	6.3	9.7	6.9	10.0	8.3	8.6	8.4	**87.7**
6	**Z-Sport 425S** Zenith Data Systems 2150 E. Lake Cook Rd. Buffalo Grove, IL 60089 (800) 553-0331 (708) 808-5000 $2,299	**Pros:** Light weight; excellent keyboard layout and response; good price. **Cons:** Unimpressive battery life; mediocre performance.	8.1	8.9	9.4	8.2	8.6	8.6	10.0	10.0	8.5	8.5	8.4	**87.7**
6	**NoteMaster 486SLC** Samsung Electronics America 105 Challenger Rd. Ridgefield Park, NJ 07660 (800) 446-0262 (201) 229-4000 $2,379	**Pros:** Good display; removable hard drive. **Cons:** Slow performance under both DOS and Windows.	8.3	8.6	9.3	8.9	9.6	7.7	9.0	10.0	8.6	8.6	8.1	**87.7**
9	**Swan 486/SLC** Swan Technologies 3075 Research Dr. State College, PA 16801 (800) 468-9044 (814) 234-2236 $2,085	**Pros:** Great price; solid construction. **Cons:** Mediocre performance under both DOS and Windows; dim display.	8.3	9.0	9.7	8.4	9.6	6.1	9.0	10.0	9.3	8.6	8.4	**87.3**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

Plug and Play Tape Backup.

The Plug.

PCComputing HARDWARE 200 1993 1993 FINALIST



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BEST SYSTEMS

486 NOTEBOOKS

Rank	Product	Pros and Cons	Display 15%	Portability 15%	Price 15%	Battery life 10%	Durability 10%	Performance 10%	Documentation 5%	Ease of installation 5%	Ergonomics 5%	Ports and expansion 5%	Service and support 5%	Total Score
1 PC Computing BEST	**Z-Sport 420S** Zenith Data Systems 2150 E. Lake Cook Rd. Buffalo Grove, IL 60089 (800) 553-0331 (708) 808-5000 $1,999	**Pros:** Great value; light weight; excellent keyboard layout and response. **Cons:** None.	8.3	9.1	9.9	8.5	10.0	8.6	10.0	10.0	8.5	8.5	8.4	**90.8**
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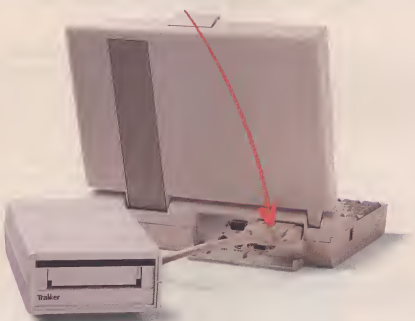
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Circle 259 on reader service card.

The Well-Connected

Don't scrimp on your LAN's critical links—get the best

With over 60 percent of business PCs networked now, we've come full circle. Just a couple of years ago, most business PCs weren't networked, and the floppy disk was making a bid for dominance as the enterprise-wide file-sharing solution. Considering that only a decade earlier mainframes and terminals were the norm and standalone computers hardly existed, it's clear that the standalone era was an anomaly.

Networks now figure prominently in business enterprises—as they should—and this section of the *PC/Computing* 200 is dedicated to helping you make the best network hardware buying decisions. Our product choices focus on the guts of a well-planned network: 486 file servers, network laser printers, and network tape backup devices. Make the right purchases and your business will realize the benefits of networked computing—an increase in productivity and in bottom-line profits.

Sharing Files and Devices

Efficient file- and device-sharing are the core issues in managing any network. Files are the basic units of exchange in computer networks. The three network hardware categories covered here reflect what work groups do with files: They exchange them with the server and other users, print them, and store them.

The modern office thrives on e-mail and file sharing, made possible by the network file server. Once a network is set up, a fast, high-quality network printer is often more economical than a distribution of cheaper, slower, usually lower-quality local printers. And network users also need to maintain safe copies of data and apps, which calls for a multigigabyte network tape backup drive.

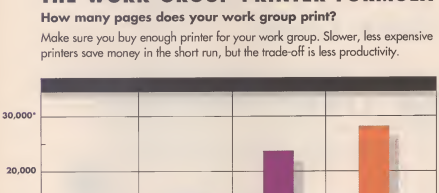
The Data Bank: Network Servers

File servers based on 486 processors are the de facto standard for network file exchange, and nothing less will do. While 386-based systems are cheap, don't buy one. A 486-based file server is going to offer not just more speed but also much more expandability. We tested 50MHz 486s with 256K of RAM cache, but if you start out with, say, a 486/33, you can upgrade your system to a 486/50 or even a 486/66 with one of Intel's clock-doubled OverDrive Processors, which cost less than $700. As faster processors arrive, you may be able to upgrade your 486 PC simply by swapping chips. But if you buy anything less than a 486 system, you've painted yourself and your network into a corner. Look for these expandability options: support for at least 128MB of RAM on the motherboard, 256K of external RAM cache, at least eight slots, and at least six total drive bays. The "Perfect File Server" on the facing page illustrates the ideal configuration for maximum performance.

THE WORK-GROUP PRINTER FORMULA

How many pages does your work group print?

Make sure you buy enough printer for your work group. Slower, less expensive printers save money in the short run, but the trade-off is less productivity.



CLASS OF LASER PRINTER

*Number of pages that can be printed nonstop in 24 hours.

Office

you can buy

INSIDE...

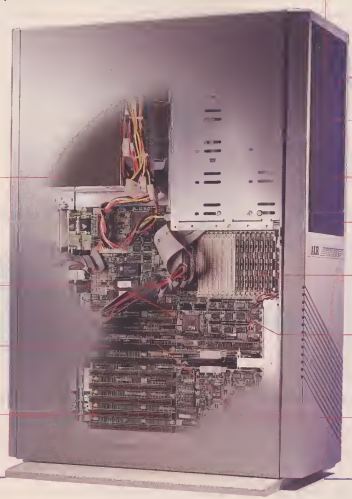
- Network Servers 166
- Network Laser Printers 170
- Network Tape Drives 178

One cautionary note relating to speed and expandability: This year's scene-stealer may well be Intel's speedy new Pentium processor, which—if it proves reliable—will help usher in widespread use of 32-bit operating systems and applications. But Pentium chips and systems will be expensive in the short run. We expect Pentium systems to cost about twice as much as comparably configured 486s. While many vendors are advertising Pentium-upgradable systems, it's not clear yet whether these systems will be compatible with the Pentium.

THE PERFECT FILE SERVER

At a network's heart, every component is crucial.

Your file server is the foundation of your network. The ideal system should include these PC components for great performance and total reliability.



PHOTOGRAPH BY HENRI RENAUDEAU. PHOTO ILLUSTRATION BY TIMOTHY EDWARD YOUNG

An important issue to consider is whether you require data redundancy as a form of fault tolerance in your 486 server. With mirrored disks, for example, the server writes the same data to corresponding places on two hard drives simultaneously. More elaborate than mirrored disks are RAIDs (redundant arrays of inexpensive disks) and accompanying software. If one drive begins to fail, the others automatically pick up the load. These redundancy options will add considerably to the cost of your server.

At Your Service: Network Laser Printers

The growing selection of network laser printers mirrors the growing popularity of PC networks. Just as the typical personal computer used to stand alone, the typical PC was also hooked up to a personal printer. But market research from InfoCorp shows that in 1993 over 60 percent of laser printers sold will be shared. The good news for buyers is that competition among vendors is making faster printers available at lower prices than ever.

The first step in buying a network printer is to evaluate the documents your organization prints. Again, the market clearly tells us what most buyers look for first: speed at printing text documents.

Laser printers that churn out 15 to 30 pages per minute are the fastest-growing segment of the laser printer market, over the personal printer (4 to 6 pages per minute) and the mid-range printer (10 to 12 ppm). (See "The Work-Group Printer Formula," page 158.) All printers process low-resolution documents faster than high-resolution documents, so you should carefully consider your need for speed versus resolution. If you're deciding between a 300-by-300-dot-per-inch and a 600-by-600-dpi printer, note that our speed tests showed minor differences in printing at the higher resolution. But in tests with Windows, printing with PCL 5 was 40 percent faster than printing with PostScript.

Connectivity and expandability issues for network printers are less complicated than you may think, for a disappointing reason: *Network printer* is, in most cases, a misnomer. Only two printers in this category that we tested—the HP LaserJet 4Si and the Compaq Pagemarq 20—can actually be configured as a node on a network, allowing you to get by without a separate print server. (See "Network-Ready Printers," facing page.)

The other printers in this category can best be described as *sharable printers.* Some of the printers we tested lack basic features necessary for efficient work group printing, such as support for both PCL 5 and PostScript 2 and emulation switching between the two, and the ability to accept print jobs from all ports simultaneously. Nine of the 11 network printers we tested had

NETWORK BACKUP AS YOU LIKE IT

Workstation- and server-based paths to peace of mind.

Prudent network backup strategy means careful consideration about the way you back up and the way you use your network. Back up from the network server, and you slow down network operation. Back up on a dedicated workstation, and you lose a PC and slow down the backup process.



FILE SERVER WITH BACKUP

+ Advantages

Backups are performed faster and you don't need a dedicated PC for network backup.

− Disadvantages

Response time of the network is reduced since the file server uses processing cycles to perform backup.



BACKUP WORKSTATION

+ Advantages

Backing up has less impact on the rest of the network.

− Disadvantages

This setup monopolizes a single workstation and the backup process is slower.

ILLUSTRATION BY ROSSI SMITH

automatic emulation switching; the HP LaserJet IIISi does it in software while the others do it in firmware (dedicated hardware). Eight of the 11 printers had all-ports-active capabilities, and six of them had both automatic emulation and all-ports-active capabilities.

What do you absolutely need in a network printer when it comes to expandability and connectivity? Insist on RAM expandability to at least 4MB, a PostScript Level 2 option, parallel and serial interfaces, and easy LocalTalk and Ethernet options. Don't let a few hundred dollars deter you from getting the best machine for the job.

Keeping It Safe: Network Tape Drives

Ask around, and you'll find that a high percentage of LANs are not backed up at all. After all, backing up and archiving network data is a tedious, never-ending task. The good news is that the process is becoming increasingly automated and, in many cases, transparent.

As is often the rule in computing, the most popular solution tends to be the simplest for compatibility reasons. When it comes to network backup, tape devices based on the QIC (quarter-inch cartridge) standard are now the most popular and, in many instances, the easiest to use.

Capacity, compatibility, media, and price can hardly be considered separately when it comes to network backup solutions. Optical disks and jukeboxes, which offer incredible capacity, still cost several thousand dollars more than other technologies. DAT (digital audio tape) drives are gaining in popularity because they access backed-up data very quickly and can hold over 4GB of data on a single tape. If you put about half that amount of data on a QIC-drive tape, which records data in multiple strips from one end of the tape to the other, retrieval can take up to twice as long as with a DAT drive.

The best thing about QIC drives is that they're cheap and compatible with other QIC drives and with every piece of backup software under the sun. No matter which media you choose, look for these software capabilities:

- Ability to back up NetWare bindery, security information, and file/directory attributes
- Ability to back up, monitor, and log the status of multiple file servers
- Robust, speedy file retrieval, including support for complex search criteria
- Customizable, informative, and accurate reporting and auditing
- Broad file system
- Password protection
- Script-building capabilities that let you automate recurring backups and tape rotation
- Automated file archiving and support for automatic deletion of old, unedited files

NETWORK-READY PRINTERS

Does built-in networking mean the end of print servers?

Traditionally, networked printers have been connected to a print server PC that routes data to the printer via a parallel cable. "Network node" printers have built-in network interfaces, so they don't need a print server and data is passed to them more than 20 times faster than with parallel-connected printers.



PRINTER/PRINT-SERVER-PC WORKSTATION

+ Advantages
Inexpensive printer options.

− Disadvantages
Requires a dedicated print server PC and prints slower.



NETWORK-NODE PRINTER

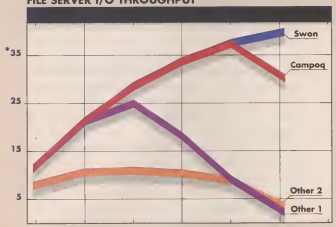
+ Advantages
Eliminates the need for a print server and prints faster.

− Disadvantages
Generally much more expensive, although prices are dropping.

MANAGING THE NETWORK LOAD

I/O throughput outweighs CPU throughput on multinode networks.

FILE SERVER I/O THROUGHPUT

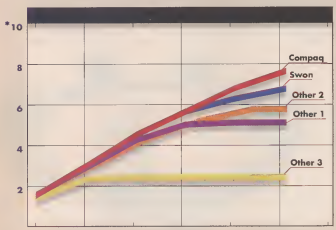


*bits/second meosured in millions

TESTS PERFORMED BY ZD LABS

Since a network server's primary jab is shuttling data among the nodes, I/O throughput is even more important than CPU power. This graph shaws that, like a servant with too many masters, same file servers chake badly in networks with mare than 9 nodes. Compaq's I/O performance remains neck-and-neck with Swan's until more than 15 nodes are in the network.

FILE SERVER CPU PERFORMANCE



* tronsoctions/second meosured in thousondths

All file servers look goad when anly a few netwark nades are active, but as more nades are added, same servers prave ta be mare equal than athers. Many af the file servers we tested stapped delivering additianal CPU power with 12 nades, while leaders Swan and Campaq continued ta deliver even with 18 active nades.

One of the most important features in a network tape drive is tape rotation. This, along with SCSI support, has made the amount of data you can fit on one tape less critical than it once was. A tape backup device with proper tape-rotation features changes tapes when one is full. SCSI support also expands QIC backup capacity by allowing you to daisy-chain a series of devices.

Last but not least, performance is key when you're backing up volumes of networked data. Unfortunately, most buyers focus on the performance of the tape backup device itself—they forget that the way you connect the drive to your LAN has an overwhelming impact on network performance as well as backup performance.

Attach a tape backup device directly to a file server, and you gain backup speed by eliminating the need to transport data between the file server and another device. You pay for this perk, however. Server-based backup takes processor power from the CPU.

By contrast, if you connect a tape backup device to a dedicated workstation on a LAN, the server's processor isn't compromised, but backup takes more time since data has to travel from the server to the workstation to the backup device. (See "Network Backup As You Like It," page 160.)

Save Money or Save Time?

Efficient sharing of files and devices—this is the principle business benefit of a well-managed network. In our tests we evaluated network file servers, printers, and tape backups for key purchase factors. Speed is a high priority, whether it's exchanging, printing, or storing network data that you're concerned with. Price is important, but focusing on price alone when selecting critical network components can be a big mistake: You can cost a large work group a lot of efficiency by trying to save a few dollars. You'll notice that the best products we tested aren't dramatically more expensive than others when you amortize them on a per-user basis.

With solutions like these, networks aren't just back they're better than ever.

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What's remote computing? Quite simply, it means taking control of your desktop PC from a portable (or another PC). And pcANYWHERE makes this easier than ever.

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But we think you'll be surprised how little you have to refer to it.

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A new idea from Peter Norton, the leader in utilities software.

To learn more about the product that can increase your office size by a few million square miles, dial FAST FAX 1-800-554-4403.* Better yet, go ahead and pick up pcANYWHERE today at your nearest retailer. It costs about $199.**

Which makes it considerably cheaper than a graduate degree in computer science.

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Circle 141 on reader service card.

*Tested on 486 PC, 4MB RAM. **Option 1, document 435. ***Suggested retail price. Actual price may vary. Valid in the U.S. and Canada only. For more information in Europe, call 31-71-353111. In Australia, call 612-879-6577. In Canada, call 1-800-465-2266. Everywhere else outside U.S., call 408-253-9570. Windows is a trademark of Microsoft Corporation. Other names are trademarks of their respective holders. ©1993 Symantec Corporation.*

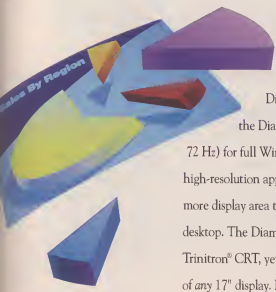

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The diamond. A product of the millennia that is everlasting. Clear, brilliant and dazzling – an appropriate reflection of the literal translation of the Mitsubishi name, which means *Three Diamonds*. Like the diamond, Mitsubishi's family of 14"/16" value priced Diamond Scan and 14"/17" high performance Diamond Pro® color monitors are the industry benchmark for quality and longevity, as well as application versatility. ♦ All Mitsubishi monitors feature high-resolution and low emission designs – at an affordable price. And unlike other monitors that often fail after just one year, Mitsubishi monitors are engineered to last and are backed by a two-year warranty on parts and labor. ♦ The Diamond Scan 14 has SVGA performance up to 1024 x 768 interlaced, while the Diamond Pro 14 offers flicker-free 1024 x 768 non-interlaced resolutions (up to 72 Hz) for full Windows™ compatibility. ♦ For advanced Windows or Macintosh® based high-resolution applications requiring a larger display, the Diamond Scan 16 provides 39% more display area than 14" models and 19% more than 15" FS designs, without crowding your desktop. The Diamond Pro 17 offers an even larger Trinitron® CRT, yet has the most compact enclosure of *any* 17" display. Both models feature the Diamond Match Color Calibration System for precise on-screen color matching. ♦ The Diamond Scan and Diamond Pro color monitors. Because nothing endures like a diamond. ♦ For more information about our full line of color monitors call us at 1-800-843-2515. In Canada, call 1-800-387-9630 or in Mexico 91-800-83456.

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MSRP: DP14 $599; DP17 $1499

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Mitsubishi Electric Sales Canada, Inc., 4299 14th Avenue, Markham, Ontario L3R 0J2

Circle 175 on reader service card.

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NETWORK SERVERS

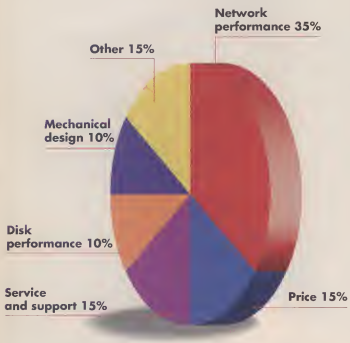
PCs that blast through network bottlenecks

The mainstay of your network is the file server. You need a system that provides uncompromised reliability plus enough horsepower to handle the heaviest network loads. It's also got to be easy to maintain and upgrade.

We set the bar high for these systems. To qualify, each server had to include a 66MHz 486DX2 or 50MHz 486DX CPU, coupled with at least 16MB of RAM and a 256K external processor cache. Also, because storage is a file server's raison d'etre, each system had to have at least 500MB of hard disk storage and two free hard drive bays. For maximum expansion space, we also specified eight free ISA, EISA, or Micro Channel architecture slots. Of the 17 systems that met these criteria, only 9 survived our rigorous round of network performance tests.

DECIDING FACTORS

At a third of the score, network performance is paramount, but support is also crucial.



Factors and Weights

Because you don't want your server to be a data bottleneck, **network performance** accounts for 35 percent of the score. Scores for this factor include the results of a CPU bandwidth test, which measures how fast the CPU processes network requests, and a network throughput test, which gauges how fast it moves data to and from network nodes. How much you pay is another key factor, and **price** therefore rates 15 percent. Another 15 percent goes to **service and support**—if you have difficulty setting up or maintaining your server (or if, heaven forbid, it crashes), you want a comprehensive, responsive support policy to get your system up and running as quickly as possible. For a similar reason, the quality of each system's **documentation** rates 10 percent.

Because a well-designed server is the easiest to maintain and upgrade, **mechanical design** accounts for 10 percent of a server's total score. Each system's **disk performance** score contributes an additional 10 percent, and **ease of installation** rates the remaining 5 percent.

How We Tested

We created a token-ring network of 18-node PCs with the test system as a file server running NetWare 3.11. The nodes were arranged on three rings of six nodes each, using a separate Madge Smart 16/4 AT Ringnode network interface card (NIC) for each ring (for EISA systems, we used 32-bit Madge Smart 16/4 EISA Ringnode NICs). The node systems were all 25MHz 386DXs with 16-bit Proteon P-1392 NICs.

We then tested the server's ability to support this network using ZD Labs' NetBench 2.05. The CPU bandwidth test measured the processing power of the server's CPU and the effectiveness of its memory cache. The network throughput test measured two factors: peak I/O throughput, which is the maximum amount of data that can be written to and read from the server; and scalability, which is a measure of the server's ability to maintain peak I/O throughput as the number of network nodes is increased.

To determine each system's raw disk and CPU processing power, we used ZD Bench 2.01. We also inspected each system to determine the quality of its design and the ease with which it could be upgraded.

PC/COMPUTING DECISION MAKER

How to buy the network server that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Network performance	Disk performance	Mechanical design	PraSignia 486DX2/66
		Documentation	Swan 486/50ES
	Mechanical design	Service and support	Swan 486/50ES
		Disk performance	Hertz 486/DX66X2Ee
Price	Network performance	Disk performance	Hertz 486/DX66X2Ee
		Service and support	SST 486DX2-66ME
	Disk performance	Service and support	Axik Ace Cache 486-50
		Mechanical design	Axik Ace Cache 486-50
Service and support	Price	Network performance	SST 486DX2-66ME
		Ease of installation	CampuAdd MC466EDX2
	Network performance	Disk performance	AST Premium SE 4/66d
		Documentation	AST Premium SE 4/66d

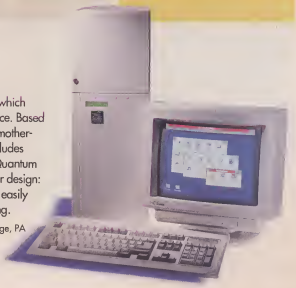
PC Computing BEST

NETWORK SERVER

Swan 486/50ES sails to top spot.

Our best all-around system was Swan Computer's 486/50ES, which combined excellent design with outstanding network performance. Based on a 50MHz 486DX processor and a full-blown 50MHz EISA motherboard, this system may seem pricey. But its $7,735 list price includes 32MB of 70-nanosecond RAM, a 256K cache, and a 1.2GB Quantum ProDrive SCSI hard disk. Plus, we loved the Swan's roomy tower design: There are 11 drive bays, and everything on the motherboard is easily accessible. There's also a flash-memory BIOS for easy upgrading.

Swan 486/50ES • Swan Technologies • 3075 Research Dr., State College, PA 16801 • (800) 468-9044, (814) 238-1820 • $7,735



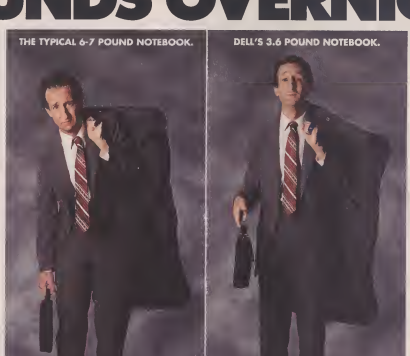
BEST NETWORK HARDWARE

NETWORK SERVERS

Rank	Product	Pros and Cons	Network performance 35%*	Price 15%	Service and support 15%	Documentation 10%	Mechanical design 10%	Disk performance 10%	Ease of installation 5%	Total Score
1 BEST	**Swan 486/50ES** Swan Technologies 3075 Research Dr. State College, PA 16801 (800) 468-9044 (814) 238-1820 $7,735	**Pros:** Great network performance; highest network I/O throughput score; easy memory upgrade; fast 16550 UART; flash BIOS. **Cons:** Expensive.	9.6	6.9	9.1	9.4	10.0	8.4	8.4	**89.6**
2	**AST Premium SE 4/66d** AST Research 16215 Alton Pkwy. Irvine, CA 92718 (800) 876-4278 (714) 727-4141 $6,985	**Pros:** Great service and support, with 24-hour 800 number for support, two years of onsite service; good documentation. **Cons:** Expensive; middling network performance score.	8.7	7.4	10.0	9.4	8.4	8.4	8.4	**87.0**
3	**CompuAdd MC466EDX2** CompuAdd Computer Corp. 12303 Technology Blvd. Austin, TX 78727 (800) 627-1967 (512) 250-1489 $5,386	**Pros:** Excellent documentation includes an error code list; easy setup and installation. **Cons:** Disassembly of drive bays impossible; expansion cards block CPU upgrade socket and lower drive bay access.	8.5	8.5	8.7	10.0	7.5	8.3	10.0	**86.4**
4	**Hertz 486/D66X2Ee** Hertz Computer Corp. 325 Fifth Ave. New York, NY 10016 (800) 323-8737 (212) 684-4141 $4,195	**Pros:** High network performance score due to very high network I/O throughput performance; low price. **Cons:** Disappointing service and support.	9.2	9.4	7.5	7.7	8.4	8.4	8.4	**86.3**
5	**Axik Ace Cache 486-50** Axik Computer 1031 E. Duane Ave., Suite F Sunnyvale, CA 94086 (800) 234-2945 (408) 735-1234 $3,298	**Pros:** Lowest price; highest PC Bench disk score due to Fujitsu hard drive with Promise IDE caching controller. **Cons:** Low network I/O throughput score; below-average support; ISA architecture.	8.0	10.0	8.2	8.3	8.4	10.0	8.4	**86.2**
6	**SST 486DX2-66ME** Sirius Systems Technology 4344 Young St. Pasadena, TX 77504 (800) 424-0724 (713) 946-0724 $4,600	**Pros:** Low price; good mechanical design, with a cache expandable to 512K; easily upgradable memory. **Cons:** Incomplete documentation; difficult hard drive upgrade; middling performance.	8.4	9.1	8.7	7.7	9.0	8.2	8.4	**85.2**
6	**ProSignia 486DX2/66** Compaq Computer P.O. Box 692000 Houston TX, 77269-2000 (800) 345-1518 (713) 370-0670 $9,275	**Pros:** High CPU bandwidth and I/O throughput scores; easily upgradable memory and hard disk; Pentium socket. **Cons:** Expensive; low scores for documentation, service, and support.	9.9	5.8	7.8	7.7	9.7	8.5	8.4	**85.2**
8	**ALR Proveiso VM4/66d** Advanced Logic Research 9401 Jeronimo Rd. Irvine, CA 92718 (800) 444-4257 (714) 581-6770 $7,311	**Pros:** Great network performance and high network I/O throughput; excellent documentation includes error code list. **Cons:** Expensive; below-average service and support; low disk scores.	9.2	7.2	7.8	9.4	8.4	8.2	8.4	**84.9**
9	**Durocom FilePro 486/66DX2E** Durocom Computer Systems 1425 Greenway Dr. Irving, TX 75038 (800) 551-9000 $3,779	**Pros:** Excellent price; documentation includes error-code list and troubleshooting section. **Cons:** Below-average network performance and middling disk performance; two slots blocked by CPU and CPU fan.	7.9	9.7	8.4	8.8	8.4	8.5	8.4	**84.7**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

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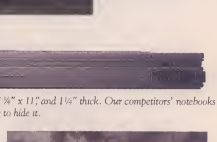


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NETWORK LASER PRINTERS

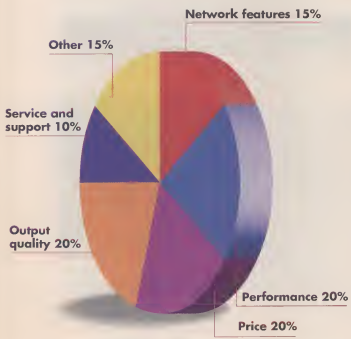
Work-group-ready printers that get the job done

To share or not to share, that is the laser printing question facing many businesses today. Whether it's more cost-effective to buy one fast network printer for the department or a personal printer for each individual depends on the size of the department.

For printer sharing with enough speed to keep up with the demands of work groups or departments of ten or more people, we considered laser printers with engine speeds of between 15 and 20 pages per minute. We capped the category at a suggested list price of $10,000, though all the printers fell far below that. The prices in the chart reflect the configuration we tested and may differ from the manufacturer's list price.

DECIDING FACTORS

Output quality, speed, and price are the main ingredients in a winning network laser printer.



We required that each printer have at least 4MB of RAM, which in some cases is more than the standard configuration. We preferred that network printers offer both PCL 5 and PostScript Level 2 printing for maximum versatility but required only that they have one or the other. A feature such as emulation switching (automatically changing between PostScript and PCL printer languages) earned extra points. Of all the printers we looked at, only 11 met all our criteria, and 7 made it onto our winners list.

Factors and Weights

Price is still crucial in any printer purchase decision, so it accounts for 20 percent of the total score. And because the equipment you buy must be able to handle your work group's or department's print jobs, which will undoubtedly include both text and graphics, we weight **performance** at 20 percent as well. All the printers have engine speeds ranging from 15 to 20 pages per minute. **Output quality** is as critical as price and performance, so it also contributes 20 percent to the final score.

Network features, including simultaneously active ports, emulation switching, and internal network interface cards, accounts for 15 percent. With one printer serving many users, **service and support** (10 percent) becomes especially important; onsite service is therefore desirable.

Setting up and configuring a printer on a network is more complicated than installing a standalone printer, so we assessed **documentation, ease of installation,** and **ease of maintenance,** each of which contributes 5 percent to the overall score.

How We Tested

Since network printers are more likely to handle a large variety of documents, we printed a variety of files to reflect the demands of a typical work group or department on a printer. The test files included text documents (10-page Microsoft Word for Windows and WordPerfect for DOS letters), documents containing graphics (a 3-page Microsoft PowerPoint presentation), and, to really test these faster engines, a 100-page Microsoft Word for Windows document containing both text and graphics. We scored print samples for each document on the output quality of the text, graphics, and grayscale images. We placed slightly more emphasis on text print quality, since text documents are the most common kind of print job.

PC/COMPUTING DECISION MAKER

How to buy the network laser printer that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Network features	Performance	Service and support	HP LaserJet 4Si MX
		Output quality	HP LaserJet 4Si MX
	Service and support	Ease of installation	Compaq Pagemarq 20
		Price	Compaq Pagemarq 20
Performance	Output quality	Price	Dataproducts LZR 1560
		Service and support	HP LaserJet 4Si MX
	Network features	Ease of maintenance	QMS 1725 Print System
		Service and support	HP LaserJet 4Si MX
Price	Performance	Output quality	Dataproducts LZR 1560
		Network features	microLaser XL Turbo
	Output quality	Service and support	Dataproducts LZR 1560
		Ease of maintenance	Dataproducts LZR 1560

PCComputing BEST

NETWORK LASER PRINTER

LaserJet 4Si MX is the network powerhouse.

Given Hewlett-Packard's track record in the printer game, it's no surprise that the LaserJet 4Si MX taps our list of network laser printers. While Campaq's Pagemarq 20 is better at printing straight text, the LaserJet flew when printing graphics-intensive documents. The LaserJet can also switch automatically between parts, printer languages, and network operating systems. And the HP is one of only two printers tested that can be configured as a standalone network node, which simplifies administrative tasks.

HP LaserJet 4Si MX • Hewlett-Packard • Direct Marketing Organization, MS 511L-SJ, P.O. Box 58059, Santa Clara, CA 95051 • (800) 752-0900 • $6,038



BEST NETWORK HARDWARE

NETWORK LASER PRINTERS

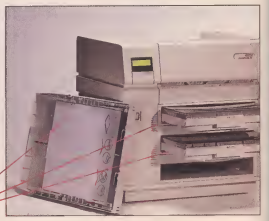
Rank	Product	Pros and Cons	Output quality 20%	Performance 20%	Price 20%	Network features 15%	Services and support 10%	Documentation 5%	Ease of installation 5%	Ease of maintenance 5%	Total Score
1	**LaserJet 4Si MX** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 752-0900 $6,038	**Pros:** Acts as a network node; fast 600-dpi printing; printer language switching; one-year onsite service. **Cons:** Expensive.	8.5	9.8	7.8	9.6	8.7	10.0	10.0	9.4	**90.0**
2	**Pagemarq 20** Compaq Computer Corp. P.O. Box 692000 Houston, TX 77269-2000 (800) 345-1518 (713) 370-0670 $5,898	**Pros:** Acts as a network node; fast text printing; printer-language switching; 400-dpi resolution; one-year onsite service. **Cons:** Expensive.	8.4	8.9	7.9	9.8	10.0	9.5	10.0	9.6	**89.7**
3	**Dotaproducts LZR 1560** Dotaproducts Corp. 6219 De Soto Ave. Woodland Hills, CA 91365 (800) 334-3174 (818) 887-8000 $3,395	**Pros:** Low price; prints crisp, dark text; fast printing; prints tabloid-size paper; easy to install. **Cons:** No emulation switching; lacks PCL 5.	9.1	9.7	10.0	6.9	8.4	7.3	10.0	9.1	**89.6**
4	**QMS 1725 Print System** QMS One Magnum Pass Mobile, AL 36618 (205) 633-4300 $5,995	**Pros:** Fast PostScript Level 2 printing; includes printer-language switching and input buffering; good graphics print quality. **Cons:** Expensive; lacks PCL 5.	8.5	9.7	7.8	9.5	7.8	8.9	10.0	9.8	**88.4**
5	**PageLaser GX400** Toshiba America Information Systems 9740 Irvine Blvd. Irvine, CA 92718 (800) 468-6744 $4,998	**Pros:** Fast text printing; excellent text print quality; advanced paper-handling options. **Cons:** Weak standard configuration; ports not active simultaneously.	8.9	9.5	8.7	8.2	8.4	8.9	8.4	7.8	**87.5**
6	**microLaser XL Turbo** Texas Instruments P.O. Box 202230 Austin, TX 78720-3320 (800) 527-3500 $3,917	**Pros:** Low price; fast PostScript printing; printer-language switching; all ports active. **Cons:** Poor graphics print quality; messy toner replacement.	7.8	9.3	9.6	9.3	7.5	7.3	6.9	6.9	**85.4**
7	**Genicom Network Laser 7170** Genicom Corp. 14800 Conference Ctr. Dr. Suite 400 Chantilly, VA 22021-3806 (800) 443-6426 $5,885	**Pros:** Fast text printing; good text print quality; advanced paper handling options. **Cons:** Poor documentation; weak standard configuration.	8.9	9.4	7.9	8.5	9.4	6.8	6.1	8.0	**85.0**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

TwinTrays increase capacity, reduce chores.

In high-volume printing environments, refilling empty paper trays can be an onerous and frequent task. **Compaq's Pagemarq 20** comes standard with three trays capable of holding a ream of paper each, for a total of 1,500 sheets. The trays—called TwinTrays—hold two side-by-side stacks of 250 sheets of paper. When the first stack is used, a slider mechanism in the the tray automatically advances the second stack. Printing continues automatically until all three trays are empty.



Three paper trays

IBM

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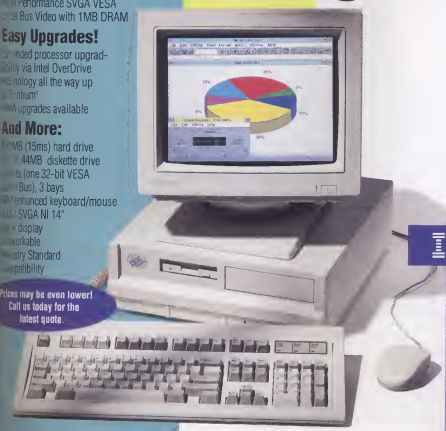
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Easy Upgrades!

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NETWORK TAPE DRIVES

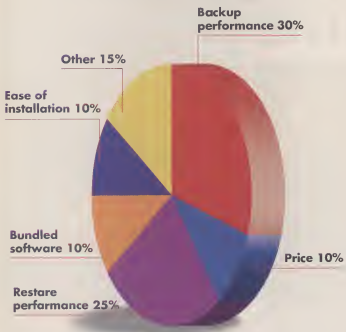
Safety nets for networks—for under $6,000

A fool and his data are soon parted. Everyone knows that networks fail, hard drives crash, and companies lose money because computer systems aren't totally reliable. But you can protect your priceless data from the unforeseen with a high-capacity network tape backup drive.

For the *PC/Computing* 200, we tested network tape backup drives with capacities of at least 1GB and list prices under $6,000. All the units are SCSI devices and use either QIC (quarter-inch cartridge) or DAT (digital audio tape) tapes. We evaluated both internal and external units; when the identical drive was available in both versions, we used the external drive. Each drive came with a tape cartridge and bundled software, and we took into account the quality and usefulness of the software in evaluating the product's performance. Our pricing reflects the network tape drive unit as tested. In some cases the cost exceeds the manufacturer's suggested price because we added the list price of the network server software Cheyenne ArcServe 4.0 NLM (20-user version). We tested a total of 32 network tape drives; 10 made the winners list.

DECIDING FACTORS

Reliable backup and restore performance are the key factors in a winning network tape drive.



Factors and Weights

Reliable performance, day after day, is the critical concern for network tape backup users. For this reason, **backup performance**—this includes speed of backup, tape verification, data comparison, and unattended backup features—accounts for 30 percent of each product's total score. Accurate **restore performance** is the other half of the reliability issue; it accounts for 25 percent of the total.

The quality of the **bundled software**, the **price**, and the **ease of installation** each account for 10 percent of the product's score. Other significant factors are **service and support** and **documentation**, both of which contribute 5 percent to a drive's total score. Also counting for 5 percent is **exception processing**, which concerns how the software handles bad data, the type and quality of error messages reported, and the type and quality of error logs generated with each operation.

How We Tested

To see how well these tape backup drives meet the challenges of various network configurations, ZD Labs conducted server-based backup and restore tests on the server alone and on the server with the local drive of a network workstation. Each test was conducted three times on the server and then on the server and workstation. We ran a tape backup and a verify to check the readability of a tape. Finally, we ran a compare to ensure the integrity of the tape data with respect to the hard drive. We tested the integrity with ZD Labs Data Generator software after deleting the old data and restoring the tape backup data. We concluded this series by testing the erase functions and unattended backup and restore performance.

To test the bundled software, we created logical disk errors such as forward and reverse, cross-linked files, and files with lost sectors. These tests determined the type and quality of the error messages generated.

PC/COMPUTING DECISION MAKER

How to buy the network tape drive that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Backup performance	Restore performance	Service and support	Tallgross FS3000e
		Bundled software	Tallgrass FS3000e
	Price	Service and support	Colorado PowerTape4000
		Bundled software	Colorado PowerTape4000
Price	Backup performance	Bundled software	Emeritus Pontero/DT-4
		Service and support	Colorado PowerTape4000
	Restore performance	Bundled software	Colorado PowerTape4000
		Service and support	Colorado PowerTape4000
Restore performance	Service and support	Exception processing	Colorado PowerTape4000
		Bundled software	Colorado PowerTape4000
	Bundled software	Backup performance	Tallgross FS3000e
		Exception processing	Tallgross FS3000e



PC Computing BEST

NETWORK TAPE DRIVES

Colorado and Tallgrass tie for top spot.

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PowerTape4000 • Colorado Memory Systems • 800 S. Taft Ave., Lovelond, CO 80537 • (800) 845-7905, (303) 669-6500 • $3,144

Tallgrass FS3000e • Tallgross Technologies • 11100 W. 82nd St., Lenexa, KS 66214 • (800) 825-4727, (913) 492-6002 • $4,690

BEST NETWORK HARDWARE

NETWORK TAPE DRIVES

Rank	Product	Pros and Cons	Backup performance 30%*	Restore performance 25%	Bundled software 10%	Ease of installation 10%	Price 10%	Documentation 5%	Exception processing 5%	Service and support 5%	Total Score
1 BEST	**PowerTape4000** Colorado Memory Systems 800 S. Taft Ave. Loveland, CO 80537 (800) 845-7905 (303) 669-6500 $3,144	**Pros:** Low price; good performance; internal Tondberg 4200 drive engine. **Cons:** Noisy drive engine.	9.0	8.8	8.4	9.0	9.2	8.9	10.0	9.5	**89.8**
1 BEST	**Tallgrass FS3000e** Tallgrass Technologies 11100 W. 82nd St. Lenexa, KS 66214 (800) 825-4727 (913) 492-6002 $4,690	**Pros:** Best performonce scores; same drive engine as PowerTape4000. **Cons:** High price; no toll-free tech support.	9.3	9.0	8.4	9.0	8.2	8.9	10.0	8.6	**89.8**
3	**Pantera/DT-4** Emeritus Technologies 2750 N. Clovis Ave. Fresno, CA 93727 (800) 228-9236 (209) 292-8888 $2,495	**Pros:** Best software package; lowest price omong winners. **Cons:** Drive ate o tape during tests.	8.4	7.6	10.0	9.5	9.7	10.0	8.1	8.6	**86.8**
4	**Panther 2000** Tondberg Data 2649 Townsgate Rd. Suite 600 Westlake Village, CA 91361 (800) 258-8285 $4,125	**Pros:** Tondberg 4200 tape drive engine; internal version available. **Cons:** Poor documentation, service, and support.	9.0	8.8	8.4	7.9	8.6	6.8	10.0	8.1	**86.4**
5	**JetStore 5000 Tape System** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 826-4111 $4,785	**Pros:** Good performonce; favorite of the ZD Lobs technicians. **Cons:** Expensive.	8.2	8.5	8.4	10.0	8.1	8.4	10.0	8.6	**85.9**
6	**DATa-bak 8** Storage Solutions 550 W. Ave. Stamford, CT 06902 (800) 745-5508 (203) 969-6047 $3,890	**Pras:** DAT drive; excellent service and support; three-yeor warranty. **Cons:** Not all the accessories shipped with the drive unit.	8.0	8.6	8.4	9.0	8.7	8.4	10.0	9.5	**85.6**
7	**DATaVault 4000** Tecmar 6225 Cochron Rd. Solon, OH 44139-3377 (800) 624-8560 (216) 349-0600 $4,895	**Pros:** Uses WongDot 3200 drive engine; greot service and support. **Cons:** Sytos software unable to back up locol workstotion.	8.1	8.5	8.4	9.0	8.0	8.9	10.0	10.0	**85.4**
8	**ProLine DATaVault 4000** Tecmar 6225 Cochron Rd. Solon, OH 44139-3377 (800) 624-8560 (216) 349-0600 $5,595	**Pras:** Bundled with unlimited user version of Cheyenne ArcServe. **Cons:** Most expensive omong winners.	8.1	8.5	8.4	9.0	7.5	8.9	10.0	10.0	**84.9**
9	**Excel 1G** Tallgrass Technologies 11100 W. 82nd St. Lenexa, KS 66214 (800) 825-4727 (913) 492-6002 $2,874	**Pras:** Fastest tape drive; average data-transfer rate of 16MB per minute; uses QIC-mini tapes. **Cons:** Slow restore times.	9.2	7.3	8.4	7.9	9.4	8.9	10.0	7.2	**84.6**
10	**JetStore 2000 Tape System** Hewlett-Packard MS 511-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 826-4111 $3,845	**Pras:** ZD Lobs used this reliable DAT drive when their tape backup drive foiled. **Cons:** Slow backup.	7.9	8.1	8.4	9.5	8.8	8.4	10.0	8.6	**84.2**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

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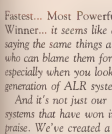


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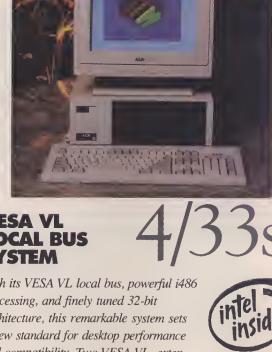
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intel inside



Video Performance Under Windows i486DX/66 CPU, Winmarks V.2.5, High Score Wins

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With the help of research, hands-on experience, and extensive lab tests, we've compiled this guide to choosing the ideal printer. See "The Perfect Laser Printer," page 187. We started by selecting printer categories that provide the best business printing solutions.

The Business Standard: PCL 5 Laser Printers Our largest printer category covers PCL 5 laser printers with rated engine speeds of 4 to 10 pages per minute. With list prices starting as low as $995 (and street discounts up to 25 percent off that price), plus 300-by-300-dot-per-inch resolution and built-in font scaling, it's no surprise that this category represents the current business standard.

If your capital budget is flexible, the 8-to-10-ppm, midrange printer is the base laser to consider. (*Note:* We cover high-speed laser printers in "The Well-Connected Office," on page 158.) Midrange lasers are more expensive (typically $1,500 to $2,000). For the higher price, you get excellent print quality, enough raw speed to serve a small work group, and sometimes the bonus of high resolution or network interface options. So-called personal lasers, which print 4 to 6 pages per minute, aren't fast enough for sharing, but they are popular as a low-cost single-user solution.

A Sharper Image: High-Resolution Laser Printers A resolution of 300-dpi just isn't good enough for business presentations, scanned photos, or company newsletters. Complicated images require higher resolution to look

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Application: Multipart forms.
Specifications: 1.8 ppm; 360 dpi; forms and tractor-feed paper.
Pros: Easy to set up and maintain; paper paths for different media.
Cons: Output quality is marginal for business text printing and unacceptable for graphics; noisy printing.



Ink Jet
Application: Memos and letters.
Specifications: 1.9 ppm; up to 360 dpi; Cut-sheet paper and transparencies.
Pros: Best value for single user; near-laser quality; quiet printing.
Cons: Slow replacing ink cartridges can be messy; ink can cause slight blur.



PCL 5 Laser
Application: Any length documents.
Specifications: 4 to 10 ppm; 300 dpi; cut-sheet paper and transparencies.
Pros: Business-quality output; versatile text and graphics printing; big street discounts.
Cons: Some have messy multipiece toner replacements.



High-Resolution Laser
Application: Graphics and presentations.
Specifications: 8 to 15 ppm; up to 800 dpi; cut-sheet paper and transparencies.
Pros: Best for business graphics; network interfaces available.
Cons: Requires more RAM; high price; slow without RISC processor.



Color Thermal Wax Transfer
Application: Business presentations and full-page images.
Specifications: 0.5 to 2 ppm; 300 dpi; glossy paper, transparencies.
Pros: Vibrant color for full-page graphics.
Cons: Business quality requires glossy paper; blended colors are dithered; slow.

Bible

got other options, too.

INSIDE...

- PCL 5 Laser Printers 190
- High-Res Laser Printers 198
- Ink Jet Printers 204
- Dot Matrix Printers 208
- Low-Cost Color Printers 214

A SMARTER WAY TO PRINT

Coprocessed printing is more efficient than dumb printing.

While dumb printing ties up the CPU, coprocessed printing converts documents for printing. This leaves the CPU free for other processing chores.

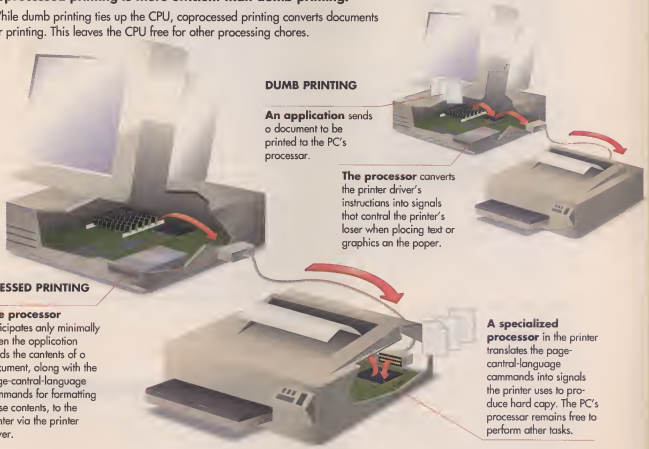


ILLUSTRATION BY PEGGY SMITH

professional. With one exception—Hewlett-Packard's LaserJet 4, which prints 600-by-600-dpi under the company's Enhanced PCL 5 printer language—the high-resolution printers we tested are PostScript based and support at least 400 by 400 dpi and rated engine speeds of 8 ppm or faster. These printers ranged in price from $2,199 to $4,595 (list price). What do you get for the money? Better image quality.

Portable and Affordable: Ink Jet Printers The ink jet market has emerged as the year's fastest-growing printer category, with longtime players Hewlett-Packard and Canon offering new models and veterans like Epson now getting into the game. Some analysts even expect ink jets to outsell lasers before the end of 1994. Whatever the outcome, ink jet is the perfect compromise between the affordability of dot matrix and the print quality of laser. In addition to being inexpensive—the monochrome ink jet printers we tested had list prices under $600—these machines are quiet, lightweight, and portable. If you're buying a single-user printer and don't mind the slow

2-ppm print speed, ink jet is the technology to choose.

Printing with Impact: Dot Matrix Printers With ink jet prices so low, most businesses will find it hard to justify buying a dot matrix printer. Although the 24-pin, narrow-carriage printers we tested have list prices under $550, this cost is not appreciably less than that of ink jet printers. In their favor, dot matrix printers are reliable workhorses for printing simple business documents, and some add features such as scalable fonts and quiet printing. However, ink jet printers offer these features in addition to printing about 15 percent faster and having near-laser print quality that dot matrix just can't match. In fact, the main reason to buy dot matrix is for printing multipart forms—the one solution only dot matrix offers.

Brighter Shades: Low-Cost Color Printers Colorful business documents are more accessible than ever. For less than $5,000, you can buy a color printer that would have cost $10,000 just two years ago. And today's model will be faster, support network interface options, and have better print quality. Unfortunately, a good all-around color business printer—one that is fast, prints on plain paper, and prints monochrome text as well as it prints color—doesn't exist yet.

We looked at color thermal wax-transfer and color ink jet printers with list prices ranging from $995 to $4,995. Thermal wax offers good print quality for full-page graphics but doesn't print text well and requires special glossy paper that is unacceptable for typical business uses. Color ink jet, on the other hand, prints on plain paper and has good print quality for text and graphics, but at 2 to 5 minutes per page, this is a very slow alternative. (See "Four Color-Printing Options," page 188.)

Doing the Write Thing

There are four important factors to consider when buying a printer: image quality, price, speed, and features (memory, fonts, and so on). Price and feature sets can be easily compared, but the only way to test printer speed is to output pages. We chose typical business documents, including a 10-page WordPerfect for DOS letter, a 10-page Word for Windows letter, a 3-page PowerPoint presentation, and, for color printers, three scanned files. We timed each document's printing time and rated output quality.

Since you want your documents to look good, image quality is all-important when you're choosing a printer. The technology that a printer uses to place dots on a page can make more of an impact than its resolution or font-scaling mechanism. Dot matrix, ink jet, laser, or color—the better the print quality, the more expensive the printer. Even if money is no object, you don't want to pay extra for a feature you don't need, so it's important to purchase a printer that can handle the kinds of documents you print most often. (See "Choose the Right Printer for the Job," page 184.)

Documents come in three basic categories: text only; mostly text with an occasional graphic; and graphics-intensive documents. If your documents are mostly text, then dot matrix, ink jet, and laser are all good choices. In fact, dot matrix is an inexpensive laser alternative, but ink jet is an especially good value for printing short text documents. For longer documents, ten pages or more, you want the speed of a laser printer.

For document types that contain an occasional graphic, laser is the best all-around solution, though ink jet is also a contender. Laser combines excellent print quality, graphics processing power, and fast throughput.

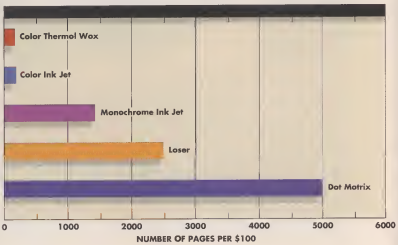
We don't recommend buying a high-resolution laser for printing occasional graphics. And the improved print quality is negligible for 10- or 12-point text. Since higher-resolution printers cost more (among the ten models we tested, the average price was double that of a midrange 300-dpi laser), paying a premium for an improvement you'll see only occasionally doesn't make sense.

An ink jet printer is the other option for occasional graphics, especially if you want color. Ink jet print quality is close to a laser's and with list prices averaging $500—half the price of a personal laser—it's much

KNOW THE OPERATING COSTS

There's more to printer costs than purchase price.

How many pages can your business print for every $100? Operating costs include the cost of consumables such as toner, ink, ribbons, and, for most color printers, special paper.



THE PERFECT LASER PRINTER

Today's printer technology brings reality close to the ideal.

A perfectly outfitted printer delivers top performance, sterling text and image quality, and fax capabilities. Here are the features to look for in a state-of-the-art laser.

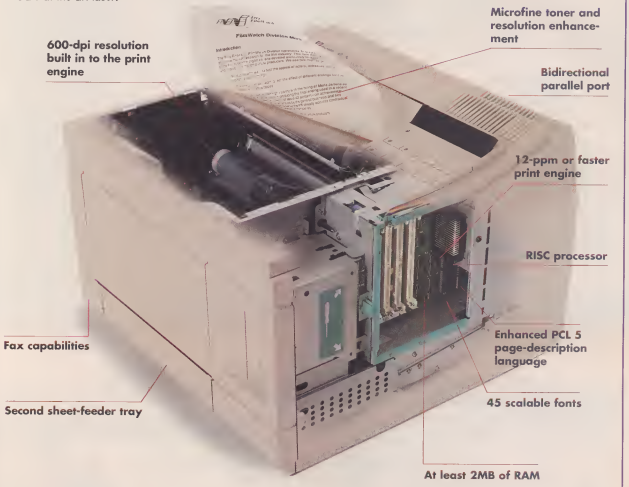


PHOTO BY IRIS SIMON. PHOTO ILLUSTRATION BY TIMOTHY EDWARD DOWNS

cheaper. Affordability comes with a loss of print speed, though, so ink jet isn't suitable for long documents.

Print nothing but presentations and graphics all day long? Start with laser. The business standard is the 300-dpi laser, but to get the competitive edge, consider a high-resolution or even a color printer. Because they have more dots to process, high-resolution printers have powerful RISC-based processors and extra memory to maintain speed. You'll pay more for them, but many high-resolution machines include network interfaces and other sharing options, so the additional upfront cost can be amortized over several users.

Color printers, too, offer network options to split the cost. Color ink jet printers are more affordable than thermal wax, starting at $1,099 list, and have the added benefit of printing on plain paper. If you're planning to network your printer, make sure you buy one with an internal processor such as the HP PaintJet XL300 or the IBM Color Jetprinter. Printers that don't have their own processors—so-called dumb printers—are nearly impossible to share over a network. Of the three dumb printers we tested, only Canon's $2,795 BJC-800 made it to our winners list. Not only did the BJC-800 have respectable speed, but its print quality was also outstanding. Although "smart" printers cost more, starting at $3,495, the added up-front expense generally pays off in faster printing and better print quality. (See "A Smarter Way to Print," page 185.)

Why not choose a color ink jet as your primary printer? One major reason is cost per page. Printer manufacturers tend to quote low costs per page for ink jet, but these numbers generally take into account a low amount of ink coverage. When ink coverage gets up above 70 percent (as it will when you're printing a copy of a presentation slide with a full-color background), it can cost 15 times as much as a laser-printed page. The other color technology, thermal wax transfer, has a set cost per page, but can cost an additional thousand dollars or more than color ink jets and requires special glossy paper. (See "Know the Operating Costs," page 186).

Fonts and Page Imaging Technology

PCL, PostScript, TrueType—what's the right combination? Unless you're in a mixed Macintosh/PC environment, the combination of PCL 5 and Windows 3.1 with TrueType has nearly eliminated the need for PostScript. PCL 5 gives you scalable typefaces but requires less memory and less processing power, and it's cheaper than PostScript.

Until recently, PostScript had some capabilities that PCL lacked—higher resolution, resident TrueType, and color. Hewlett-Packard has built those capabilities into separate versions of PCL—higher resolution and TrueType in the LaserJet 4 and color in the PaintJet XL300. Now that Hewlett-Packard has broken down the barrier between PostScript and the rest of the printing universe, it's a matter of months until powerful PCL-based high resolution and color alternatives are available.

Why buy a PostScript printer? PostScript lets you proof documents that will go to a Linotronic device or image setter. You get document portability—that is, printed documents have the same page formatting no matter what the output device is—which PCL doesn't provide. Another attractive feature is the option for PostScript fax. A printer with Adobe PostScript Fax capability and an internal fax modem can receive a fax from a similarly equipped device at a resolution of 300 dpi, as compared with the standard fax resolution of 200 by 100 dpi. This allows you to send and receive original-quality documents via fax.

Printer of the Future

The LaserJet 4 set new standards for the business laser printer. We expect 600-dpi resolution, built-in TrueType fonts, bidirectional communications, and built-in fax capability to become standards for business laser printing by next year. But even the addition of these features won't mean that one printer can handle all of your print jobs—we're still several years away from that.

Meanwhile, remember that all printers are not created equal. PCL 5 laser printers excel at most printing tasks, but ink jet, dot matrix, high resolution, and color have their strong points. In a well-run office, there's plenty of room for a mix of all these printing technologies.

Four Color-Printing Options

Which technology is right for you? That depends on your application.



Color Ink Jet
Application: Graphics, reports, letters.
Specifications: 0.5 ppm; 51 cents per page (30 percent ink coverage); plain paper and transparencies.

Pros: Accepts a variety of print media; business-quality text and graphics; quiet.
Cons: Slow print times; mediocre flesh-tone photo reproduction; some units have messy ink replacements.



Thermal Wax Transfer
Application: Presentations, full-page images.
Specifications: 0.5 to 2 ppm; 56 cents per page (any ink coverage); glossy paper and transparencies.

Pros: Vibrant color for full-page graphics; flesh tones reproduce well.
Cons: Requires glossy paper; blended colors are dithered; slow print times.



Solid Ink
Application: Presentations, reports, letters.
Specifications: 0.5 to 1 ppm; 32 cents per page (30 percent ink coverage); plain paper and transparencies.

Pros: Brilliant thermal-wax-like color on plain paper; business-quality text and graphics.
Cons: Slow printing; double the purchase price of ink jet printers.



Dye Sublimation
Application: Presentations, color proofing.
Specifications: 0.25 ppm; $2.25 per page (any ink coverage); glossy photo paper and transparencies.

Pros: 24-bit, continuous-tone color at near-photographic quality; no dithering.
Cons: Expensive (around $10,000); prints only on glossy paper; highest cost per page; slowest printing.



Introducing PacificPage 4. The latest addition to a very prominent family.

The latest member of the award winning PacificPage® family has arrived. Called PacificPage 4, it's designed just for the new LaserJet® 4 printer.

Like all of its earlier family members, PacificPage 4 provides full PostScript® language emulation. The same 35 Apple® LaserWriter® scalable typestyles. And all of PostScript's powerful graphics capabilities. It also accepts downloaded Type 1 and 3 font formats.

Just install the SIMM module into any of your printer's memory slots. With 4 MB of additional printer memory, PacificPage 4 can print your PostScript output at an impressive 600 dpi resolution. You'll get sharp, crisp output that you'd expect only from an expensive, high-end PostScript device.

And your PostScript files will be printed quickly because PacificPage 4 utilizes the i960™ processor built into each LaserJet 4.

If your printer is on a network, you never have to worry about confusing the printer with PCL and PostScript files.

PostScript language emulation for the LaserJet 4

That's because PacificPage 4 fully supports the automatic language sensing and switching feature of the LaserJet 4.

Like all of the PacificPage products before it, PacificPage 4 is covered by a full lifetime warranty and is backed by a 60-day money back guarantee of satisfaction.

With all of these impressive features and capabilities, you'll be surprised to learn that PacificPage 4 is priced at a low $299. Although, if you're familiar with PacificPage 4's predecessors, you know that high quality and low price run in the family.

For the dealer nearest you or to order PacificPage 4, call (619) 625-3627 Fax (619) 552-0889.

Be sure to ask about Pacific 4 SIMM Memory™ — 1, 2, 4, and 8 MB memory upgrades for the LaserJet 4.

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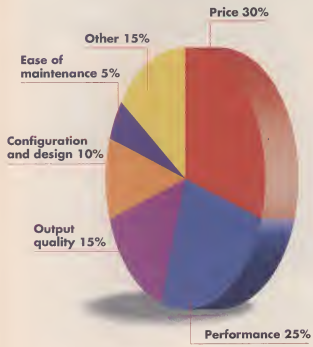
PCL 5 LASER PRINTERS

Setting the standard for business-quality printing

PCL 5 laser printers have two significant advantages over other printers on the market today—they're cheap, and they're lasers. Along with an affordable price, you get the crisp output that has become the standard for business correspondence. What's more, these printers' use of PCL 5, the most recent version of the popular laser printer language, provides the additional benefits of application compatibility, scalable fonts, and the ability to manipulate graphics. These printers are indispensable in any office, whether used alone on a desktop or shared via a network or some other printer-sharing setup. The price and performance of PCL 5 printers also make them a great choice for a home office.

DECIDING FACTORS

With near-commodity items like these lasers, price is the primary factor, but speed is also critical.



All the PCL 5 printers we tested in this category had to support 300-by-300-dot-per-inch resolution and print at least 4 to 10 pages per minute. In addition, every printer had to have at least 1.5MB of RAM, which in some cases exceeded the standard configuration, and a parallel port. Some printers were configured with a PostScript-language option; if so, this was reflected in the list price. Of the 18 printers we evaluated, we selected 10 as winners.

Factors and Weights

Because of the commodity-like nature of the printers in this category, **price** is the primary differentiating factor; it accounts for 30 percent of the printer's total score. In addition to price, however, most buyers choose laser printers for their ability to churn out high-quality pages quickly. Because this type of printer is likely to get heavy use in an office, we weighted the **performance** score, which reflects the time it takes the printer to output both text and graphics, at 25 percent.

Buyers opt for a laser printer over a less expensive printer because of its ability to produce business-quality documents that include both text and graphics. As a result, we rate **output quality** as 15 percent of the score. **Configuration and design,** which determines how functional the printer will be, includes its physical dimensions, the amount of memory, and the number of fonts and interfaces that come standard; it accounts for 10 percent.

Finally, **documentation, ease of installation, ease of maintenance,** and **service and support** affect how easy it will be to keep the printer in good running order. We assigned a weight of 5 percent to each.

How We Tested

To rate performance, ZD Labs technicians ran a series of tests to determine each printer's speed in producing a range of typical business documents: a ten-page WordPerfect for DOS text document, a ten-page Microsoft Word for Windows text document, and a Microsoft PowerPoint business presentation containing graphics. ZD Labs technicians printed each document three times on every printer to determine an average speed. Then we combined the results of the three tests to arrive at the overall performance figure.

ZD Labs also compared the output quality of the print samples, such features as the printers' front-panel controls, and the helpfulness of the error messages.

PC/COMPUTING DECISION MAKER

How to buy the PCL 5 laser printer that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Price	Performance	Output quality	Tandy LP 800
		Maintenance	Epson EPL-8000
	Output quality	Performance	Epson ActionLaser 1500
		Service and support	Epson ActionLaser 1500
Performance	Output quality	Price	Epson EPL-8000
		Maintenance	Fujitsu PrintPartner
	Maintenance	Price	Epson EPL-8000
		Service and support	Epson EPL-8000
Output quality	Price	Performance	Epson ActionLaser 1500
		Service and support	Epson ActionLaser 1500
	Performance	Price	Epson ActionLaser 1500
		Maintenance	HP LaserJet 4

PC Computing BEST

PCL 5 LASER PRINTER

Sharp output at a rock-bottom price.



The Epson ActionLaser was the lowest-priced printer in the final list of winners. Besides being a bargain, this 6-page-per-minute printer produced high-quality output, outranking every other printer in the category except the 600-dpi Hewlett-Packard LaserJet 4. The sharp looks come courtesy of the printer's use of RITech (resolution improvement technology), which smooths the jagged edges of the 27 resident fonts (13 of them scalable). Epson offers a two-year limited warranty on the ActionLaser 1500.

Epson ActionLaser 1500 • Epson America • 20770 Madrona Ave., Torrance, CA 90503 • (800) 922-8911, (310) 782-0770 • $1,097

"*No other program lets you create presentations so quickly and effortlessly, and none pays so much attention to guiding you through the process.*"
PC Computing 12/92 MVP Award

"*Remarkably easy to use...*"
Windows Magazine 2/93

"*When you've got the best product going, you can afford to relax. In this case, Lotus didn't. Freelance is a winner.*"
PC World 1/93

The first rule of any presentation is keep it simple.

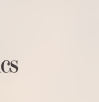
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Now people not only use Freelance Graphics to easily create beautiful last minute presentations, they use it to quickly generate handouts, even for informal meetings.



Let our SmartMasters be your guide.

Only Freelance Graphics has SmartMasters™ to automatically guide you through every step of the design process. You simply select the look you want, choose a page layout, and start filling in the blanks. It's that easy.

Just one click brings you a complete array of drawing, charting and editing tools, plus on-screen galleries for chart types, symbols, tables, and org. charts. You'll easily create professional quality output in overhead, slide, handout, and screen show formats. And a new toggle switch allows you to instantly view your presentation

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"Creating a presentation of even (100 slides) is absurdly easy—and much easier, in many ways, than with competing products..."

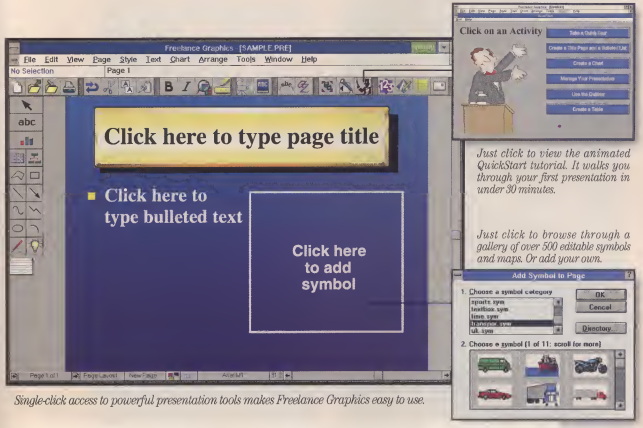
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My disk format is: ☐ 3½" ☐ 5¼" Do you currently own a graphics package? ☐ Yes ☐ No



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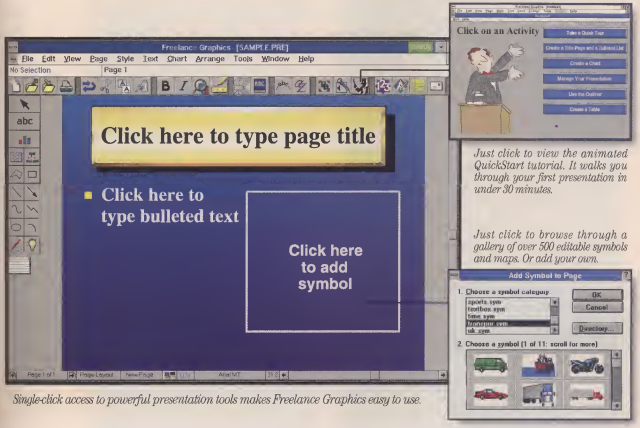
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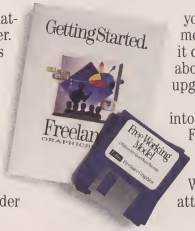
Single-click access to powerful presentation tools makes Freelance Graphics easy to use.

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You'll be amazed at the beautiful results you immediately generate, without really trying. In fact, you couldn't look bad even if you tried.

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Lotus Freelance Graphics 2.0

Presentation Graphics for Windows

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BEST PRINTERS

PCL 5 LASER PRINTERS

Rank	Product	Pros and Cons	Price 30%*	Performance 25%	Output quality 15%	Configuration 10%	Documentation 5%	Ease of installation 5%	Ease of maintenance 5%	Service and support 5%	Total Score
1 EDITORS' CHOICE BEST	**ActionLaser 1500** Epson America 20770 Madrona Ave. Torrance, CA 90503 (800) 289-3776 (310) 782-0770 $1,097	**Pros:** Very low price; sharp output; 13 scalable fonts; two-year limited warranty. **Cons:** Unexceptional 6-ppm speed.	10.0	8.2	9.7	8.8	9.1	9.0	9.1	9.6	**92.3**
2	**LaserJet 4** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051-8059 (800) 752-0900 $2,199	**Pros:** Great 600-dpi output; speedy. **Cons:** Bulky design; highest price in category.	7.5	9.5	10.0	9.5	10.0	10.0	10.0	8.3	**89.9**
3	**Epson EPL-8000** Epson America 20770 Madrona Ave. Torrance, CA 90503 (800) 289-3776 (310) 782-0770 $1,697	**Pros:** Speedy; scalable fonts built-in; two-year limited warranty. **Cons:** Average output quality.	8.6	9.3	8.2	8.5	8.6	9.0	10.0	9.6	**88.5**
4	**Star LS-5EX** Star Micronics America 420 Lexington Ave. Suite 2702 New York, NY 10170 (800) 447-4700 $1,149	**Pros:** Excellent price; high-quality output; easy to maintain; compact size. **Cons:** Below-average performance.	9.9	7.3	8.4	8.5	7.3	8.5	10.0	8.7	**86.3**
5	**PrintPartner 10** Fujitsu Computer Products of America 2904 Orchard Pkwy. San Jose, CA 95134 (800) 626-4686 $2,154	**Pros:** Speediest in category; sharp output; easy to install. **Cons:** Expensive.	7.6	9.8	8.2	8.4	9.1	9.5	9.1	8.7	**86.2**
6	**Silentwriter Model 95** NEC Technologies 1414 Massachusetts Ave. Boxborough, MA 01719 (800) 386-8888 (508) 264-8000 $1,749	**Pros:** Comes with PostScript and an AppleTalk port. **Cons:** Unexceptional 6-ppm speed; unwieldy size.	8.5	8.2	8.2	9.6	9.1	9.0	9.1	9.2	**86.1**
7	**MT 908** Monnesmann Tally 8301 S. 180th St. P.O. Box 97018 Kent, WA 98064-9718 (800) 843-1347 $2,155	**Pros:** Excellent output quality; good 8-ppm speed. **Cons:** Expensive.	7.6	9.2	9.6	8.5	8.6	7.5	7.4	10.0	**85.5**
8	**ProWriter CI-8E** C-Tech Electronics 2515 McCabe Way Irvine, CA 92713 (800) 347-4017 (714) 833-1165 $1,860	**Pros:** Good speed and output quality; compact. **Cons:** Clumsy two-part toner/drum design.	8.3	9.2	8.4	7.9	8.2	8.5	7.4	9.2	**85.1**
9	**PageLoser GX200** Toshiba America Information Systems 9740 Irvine Blvd. Irvine, CA 92713 (800) 468-6744 $1,799	**Pros:** Good speed and output quality. **Cons:** Clumsy two-part toner/drum design.	8.4	9.2	8.1	8.3	8.2	8.5	7.4	8.3	**84.9**
10	**Tandy LP 800** Tandy Corp. One Tandy Center Fort Worth, TX 76102 (817) 390-3011 $1,499	**Pros:** Very good price for an 8-ppm printer. **Cons:** Below-average documentation.	9.1	9.2	8.2	7.9	6.3	8.0	7.4	6.6	**84.7**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

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HIGH-RES LASER PRINTERS

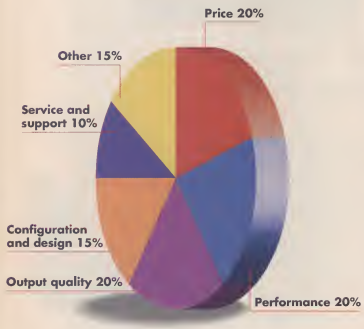
Finally—fast text and great graphics

For years, the business world was satisfied with 300-by-300-dot-per-inch resolution for laser printer output—but no longer. Not when some otherwise standard-issue lasers are producing 400-by-400-dpi output, and when printers offering even higher resolutions cost less than $6,000. High-resolution printers let you print much sharper text and graphics from the desktop, not to mention great-looking halftones. This is a boon for any business that produces publications or complicated drawings, or simply appreciates and can afford such output.

The ten high-resolution printers we evaluated for the Superguide had to print at least 8 pages per minute and use either the PCL 4 or the PCL 5 printer language. Level 1 or Level 2 of the PostScript language had to be available as an option if it wasn't standard. Also, each printer had to have at least 4MB of memory and a list price no higher than $6,000. Of the ten printers tested, two offered 400-by-400-dpi output, another one produced 800 by 800, and the remainder provided 600-by-600-dpi resolution. We narrowed our final list to six printers.

DECIDING FACTORS

A high-res printer should deliver ultrasharp output, but not at the cost of speed—or at a high price.



Factors and Weights

Price, performance, and **output quality** each contribute 20 percent to the total score. As with other types of printers, price is an important consideration. But in this category, it's not the single most important factor, because high-res printers have only recently become affordable and don't offer the low prices expected of the more commodity-like PCL laser and dot matrix printers. Performance is critical, because the images you're likely to produce are complex, and a high-resolution printer that is painfully slow offers an unacceptable trade-off. And since you want ultrasharp text and images, output quality is also a major consideration.

Configuration and design accounts for 15 percent of the score. It includes such important details as the top resolution supported (such as 400-by-400 or 800-by-800 dpi), the number of resident fonts, and the amount of memory that comes standard. **Service and support** (10 percent) is weighted more heavily here because high-res printers are expensive and should offer above-average service. And because a printer is essential to the smooth flow of any business's work load, we considered **ease of installation, ease of maintenance,** and **documentation** as worth 5 percent each of the total score.

How We Tested

We measured each printer's speed with a range of jobs, from standard text files to graphics-laden documents that especially call for a high-res printer. The output included a 10-page WordPerfect for DOS document, a 10-page Microsoft Word for Windows document, and a 3-page Microsoft PowerPoint presentation. ZD Labs technicians printed each document three times to calculate an average speed; we then combined these averages to arrive at the final performance figure.

We judged output quality by comparing each printer's sample of the WordPerfect and Word text documents, the business graphics in the PowerPoint document, and grayscale images produced with CorelDraw.

PC/COMPUTING DECISION MAKER

How to buy the high-res laser printer that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Price	Performance	Output quality	LaserJet 4
		Configuration and design	LaserJet 4
	Output quality	Service and support	Apple LaserWriter Pro 630
		Configuration and design	LaserJet 4
Performance	Price	Service and support	Dataproducts LZR 965
		Configuration and design	Dataproducts LZR 965
	Output quality	Configuration and design	LaserJet 4
		Service and support	Apple LaserWriter Pro 630
Output quality	Price	Performance	Apple LaserWriter Pro 630
		Configuration and design	Apple LaserWriter Pro 630
	Performance	Price	LaserJet 4
		Configuration and design	Apple LaserWriter Pro 630

PC Computing BEST

HIGH-RES LASER PRINTER

HP's LaserJet 4 combines high quality, low price.

The Hewlett-Packard LaserJet 4 is a breakthrough printer, providing 600-by-600-dot-per-inch resolution and 8-page-per-minute speed for only $2,498—a price that is sure to drop significantly at discount outlets. While some printers produced sharper output, the HP's documents were far from disappointing. It also offers 45 built-in scalable fonts. The LaserJet 4 is easy to set up and maintain, comes with superb documentation, and is backward-compatible with earlier LaserJets.



LaserJet 4 • Hewlett-Packard • Direct Marketing Organization, MS 511L-SJ, P.O. Box 58059, Santa Clara, CA 95051 • (800) 752-0900, (208) 323-2551 • $2,498

BEST PRINTERS

HIGH-RES LASER PRINTERS

Rank	Product	Pros and Cons	Output quality* 20%	Performance 20%	Price 20%	Configuration 15%	Service and support 10%	Documentation 5%	Ease of installation 5%	Ease of maintenance 5%	Total Score
1 BEST	**LaserJet 4** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 752-0900 $2,498	**Pros:** Low price; very good 600-dpi output; 45 built-in scoloble fonts; very easy installation and maintenance. **Cons:** Unwieldy size.	8.3	9.6	9.9	10.0	7.9	10.0	10.0	10.0	**93.5**
2	**LaserWriter Pro 630** Apple Computer 20525 Mariani Ave. Cupertino, CA 95014 (800) 776-2333 $2,529	**Pros:** Provides interfaces for both the PC and Macintosh; excellent output. **Cons:** Bare-bones control panel.	8.9	9.1	9.9	9.4	8.9	9.3	8.8	7.5	**91.6**
3	**LaserJet 4M** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 752-0900 $2,999	**Pros:** Macintosh version of our category winner provides the some great features. **Cons:** Unwieldy size.	8.4	9.2	9.1	10.0	7.9	10.0	10.0	10.0	**91.3**
4	**Dataproducts LZR 965** Dataproducts Corp. 6219 De Soto Ave. Woodland Hills, CA 91365 (800) 334-3174 (818) 887-8000 $2,445	**Pros:** Least expensive of the 600-by-600-dpi printers; fost print speed. **Cons:** Below average setup and maintenance.	7.3	9.5	10.0	9.7	8.9	10.0	6.5	5.8	**88.2**
5	**IBM LaserPrinter 10P** Lexmark Int'l 740 New Circle Rd. Lexington, KY 40511 (800) 258-8575 (606) 232-2000 $2,499	**Pros:** Similar to the HP LaserJet 4 in low price and high quality of output. **Cons:** Documentation and installation could be improved.	8.4	7.9	9.9	8.6	10.0	7.8	7.7	9.2	**87.7**
6	**Dataproducts LZR 1560** Dataproducts Corp. 6219 De Soto Ave. Woodland Hills, CA 91365 (800) 334-3174 (818) 887-8000 $3,395	**Pros:** Speediest of the high-res printers; very easy to set up. **Cons:** Output quality not as sharp as some of the other printers; print-density diol not clearly labeled.	7.8	10.0	8.4	8.4	8.9	7.8	10.0	9.6	**87.6**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Day-Glo "Paper low" indicator attracts attention.

An enclosed paper drawer is a great space-saving feature, but it's hard to know when to add paper. **Apple's LaserWriter Pro 630,** however, has an indicator on the outside of the drawer in Day-Glo orange that simply screams when paper is low.





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PC MAGAZINE EDITORS' CHOICE
June 30, 1992
FlexScan F550i

1993 W-100 WINDOWS MAGAZINE WINNER AWARD
FlexScan F550i

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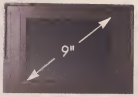
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INK JET PRINTERS

The low-cost alternative to the laser printer

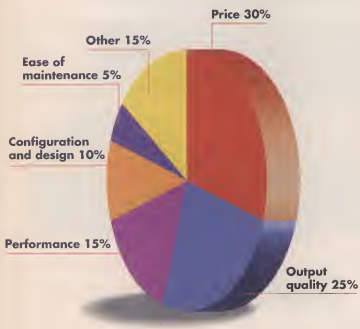
Ink jet printers are the sleeper hit of the year. Offering better print quality and quieter operation than dot matrix printers and greater affordability than 4-page-per-minute laser printers, ink jets have become a worthy laser alternative.

This year's fastest-growing printer category, ink jets are also one of the most versatile, printing in both black and white and color with equal ease. We tested 11 black-and-white ink jet printers for this category (we included color ink jets in the Low-Cost Color Printers category) and came up with 7 winners. Although these printers were fairly slow, averaging just 2 pages per minute, they supported at least 300-by-300-dot-per-inch resolution, equal to that of many laser printers, and some even supported 360-by-360-dpi resolution for superior output quality.

The list prices of the ink jet printers we looked at ranged from $299 to $599—hundreds of dollars less than the quintessential personal printer, Hewlett-Packard's LaserJet IIP Plus. And ink jet printer prices are continuing to drop. Even with significant street discounts, which average 35 percent, several companies dropped their list prices still further just as we were going to press.

DECIDING FACTORS

In buying an ink jet, price is the top factor, but output quality comes in close behind.



Factors and Weights

The main advantage in buying an ink jet printer is its low cost, and accordingly **price** is the most important factor in this category, contributing 30 percent of each product's total score. To be as fair as possible, we evaluated each printer using the manufacturer's list price. Next in importance is **output quality** at 25 percent. Since these printers are an alternative to 300-dpi laser printers, it's crucial that their print quality be up to business standards. Although graphics print quality affects the scores for this factor, it carries less weight than print quality for text.

Ink jet printers aren't generally purchased for their speed, and so **performance** contributes only 15 percent of the overall score. Scores for **configuration and design**, which take into consideration noise level, footprint, and inclusion of a sheet feeder, contribute 10 percent of the total score. Finally, since ease of use is of concern with any hardware product, **service and support, ease of installation, ease of maintenance,** and **documentation** each account for 5 percent of a product's score.

How We Tested

Ink jet printers are best suited for printing text-based, as opposed to graphics-based, documents. ZD Labs timed each printer with a variety of text-only documents, including a 2-page letter, a 10-page WordPerfect for DOS document, and a 10-page Microsoft Word for Windows document. The lab technicians printed each document at least twice, recording how long it took to print; print times were averaged. We then compared the text quality of these documents to rate each printer's output quality. We also printed a small graphic element to compare the print quality.

PC/COMPUTING DECISION MAKER

How to buy the ink jet printer that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Price	Output quality	Performance	DEC multiJet 1000
		Configuration and design	DEC multiJet 1000
	Performance	Output quality	Epson Stylus 800
		Configuration and design	DEC multiJet 1000
Output quality	Price	Configuration and design	DEC multiJet 1000
		Performance	Canon BJ-200
	Configuration and design	Ease of maintenance	Canon BJ-200
		Performance	Canon BJ-200
Performance	Output quality	Price	Canon BJ-200
		Configuration and design	Canon BJ-200
	Price	Output quality	Epson Stylus 800
		Configuration and design	Canon BJ-200

PC Computing BEST

INK JET PRINTER

Canon's BJ-200 speeds to the top.

The top-scoring ink jet printer is the Canon BubbleJet BJ-200. It offers the fostest ink jet printing, ronks neor the top for print quolity, ond is quiet ond lightweight. This printer excels at printing stroight DOS text, ond olso printed Windows text fost with good print quoli-ty. The secret to this printer's crisp text is its 360-by-360-dpi resolu-tion, which gives it the edge over the competition. At press time Canon dropped the list price to $449, moking o good buy even better.



Canon BJ-200 • Canon Computer Systems • 123 E. Paularino Ave., P.O. Box 5048, Costa Mesa, CA 92628-5048 • (800) 848-4123, (714) 438-3000 • $549

BEST PRINTERS

INK JET PRINTERS

Rank	Product	Pros and Cons	Price 30%*	Performance 15%	Output quality 25%	Configuration 10%	Documentation 5%	Ease of installation 5%	Ease of maintenance 5%	Service and support 5%	Total Score
1	**Canon BJ-200** Canon Computer Systems P.O. Box 5048 Costa Mesa, CA 92628-5048 (800) 848-4123 (714) 438-3000 $549	**Pros:** Fast DOS/Windows printing; excellent 360-by-360-dpi text print quality. **Cons:** Price somewhat high.	8.2	9.7	9.4	9.1	9.3	10.0	8.8	9.3	**90.4**
2	**DEC multiJet 1000** Digital Equipment Corp. 146 Main St. Maynard, MA 01754-2571 (800) 344-4825 (508) 493-5111 $299	**Pros:** Lowest price in category; good print quality; small footprint. **Cons:** Slow performance.	10.0	8.3	9.4	8.5	7.4	6.7	7.6	10.0	**90.1**
3	**Epson Stylus 800** Epson America 20770 Madrona Ave. Torrance, CA 90503 (800) 289-3776 (310) 782-0770 $449	**Pros:** Excellent performance; low price. **Cons:** Poor Windows text print quality; large footprint.	8.9	9.5	8.8	8.0	8.1	9.3	8.8	9.3	**88.6**
4	**Kodak Diconix 701** Eastman Kodak 343 State St. Rochester, NY 14650 (800) 344-0006 (716) 724-4000 $479	**Pros:** Good graphics print quality; small footprint; reasonable price. **Cons:** Slow.	8.7	7.9	8.1	9.6	9.3	10.0	10.0	9.3	**86.9**
5	**Royal CJP 450** Royal Consumer Business 765 U.S. Hwy. 202 Bridgewater, NJ 08807 (800) 527-2960 (908) 526-8200 $499	**Pros:** Best all-around print quality; small footprint. **Cons:** Slow printing; poor service and support.	8.6	8.3	9.5	8.2	7.8	7.4	8.2	7.0	**85.3**
6	**HP DeskJet Portable** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 752-0900 $599	**Pros:** Small footprint; lightweight; fast printing. **Cons:** Sheet feeder optional; pricey.	7.8	9.5	8.4	8.8	8.9	9.3	10.0	7.0	**85.2**
7	**HP DeskJet 500** Hewlett-Packard MS 511L-SJ P.O. Box 58059 Santa Clara, CA 95051 (800) 752-0900 $599	**Pros:** Fastest Windows printing; good graphics print quality. **Cons:** large footprint; pricey.	7.8	9.6	8.4	7.8	8.1	8.0	8.2	8.5	**83.0**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Canon's printhead means faster ink jet printing.

Ink jet printers aren't the fleetest, but **Canon's BJ-200** has a 64-nozzle printhead that deposits ink twice as fast as previous BubbleJet printers. Each of the 64 nazzles an the Canon BJ-200 printhead emits 6,200 bubbles af ink per secand—a 72 percent edge over HP's DeskJet 500. That, cambined with a faster, mare accurate printhead mechanism, makes the BJ-200 the fastest ink jet printer tested.



Printhead



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TI vs. HP.

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POSTSCRIPT™ Software from Adobe

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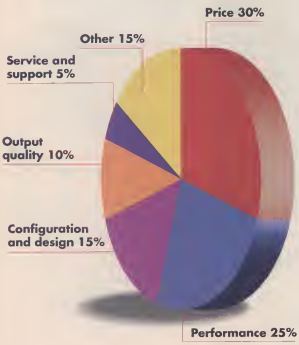
DOT MATRIX PRINTERS

Speedy, affordable workhorse printers for the office

Despite yearly predictions of its demise, the dot matrix printer lives on and on. And why not? These humble printers are reliable workhorses and still the easiest way to print to multiple-part forms. They're great for churning out documents—packing labels, order forms, invoices, and in-house memos—that don't need to look fancy. With dot matrix printers adding scalable fonts, color capabilities, and other features to distinguish themselves in a crowded field, they also are quite suitable for simple business documents. In addition, dot matrix printers have always been highly affordable, and they require little more upkeep than a new ribbon now and then.

DECIDING FACTORS

Price and print speed are the most important concerns in choosing a dot matrix printer.



To qualify for testing in this category, the 24-pin dot matrix printers needed a narrow carriage that accommodates letter-size paper only. All printers had to be able to print at a speed of 180 characters per second in draft mode, and they had to have a list price of under $550. We tested a total of 13 printers and arrived at a final list of 12 winners.

Factors and Weights

Dot matrix printers are generally considered commodity items, so **price** and **performance** carry the most weight—at 30 percent and 25 percent, respectively—in determining a product's overall score. And because dot matrix printers have such similar capabilities, price obviously is of paramount concern. Because buyers also want a hassle-free printer that can quickly churn out a high volume of pages, performance is the other critical factor in the scoring.

A printer's **configuration and design** accounts for 15 percent of the score. While all 24-pin dot matrix printers operate in much the same fashion, there are differences in the printers' size, the variety of fonts offered, the number of paper paths, control-panel functionality, and noise level. These elements help determine how convenient the printer is to use. **Output quality** contributes 10 percent to the total score.

Since a dot matrix printer is likely to be in nearly constant use in an office, you want a unit that is easy to get up and running—and that will keep on running. **Documentation, ease of installation, ease of maintenance,** and **service and support** all determine how easy a printer is to use and maintain, so each of these factors accounts for 5 percent of the total score.

How We Tested

We measured each printer's performance by rating its average speed in producing a variety of documents that users would be most likely to use a dot matrix for. We printed a 10-page WordPerfect for DOS text document and a 10-page Microsoft Word for Windows text document three times on each printer to obtain an average speed for these print jobs. Then we printed a simple test document twice on each printer to get an average speed for graphics and text output. We combined the results for these three tests to arrive at the overall performance figure. In addition, as the printers were being put through their paces, the technicians judged their noise level.

PC/COMPUTING DECISION MAKER

How to buy the dot matrix printer that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Price	Performance	Configuration and design	Brother M-1324L
		Output quality	Star NX-2430 Multi-Font
	Configuration and design	Performance	Brother M-1324L
		Service and support	Epson ActionPrinter 3250
Performance	Price	Configuration and design	Tandy DMP 302
		Service and support	NEC Pinwriter
	Configuration and design	Price	Citizen GSX-240
		Output quality	Tandy DMP 302
Configuration and design	Price	Performance	Citizen GSX-240
		Service and support	Epson ActionPrinter 3250
	Performance	Price	Citizen GSX-240
		Output quality	Citizen GSX-240

PC Computing BEST

DOT MATRIX PRINTERS

Citizen's GSX-240 ties with NEC's Pinwriter.

Our tests resulted in a tie for the top-scoring product. The Citizen's well-rounded feature set makes it a standout. It's easy to set up and use, with an informative LCD panel to guide you through selections, including a choice of two scalable fonts. The speedy NEC Pinwriter, which has a slightly lower price than the Citizen, earned the top score in the performance test. The Pinwriter produces excellent output and is also extremely easy to set up and maintain.



Citizen GSX-240 • Citizen America Corp. • 2450 Broadway, Suite 600, P.O. Box 4003, Santa Monica, CA 90411-4003 • (800) 477-4683, (310) 453-0614 • $519

NEC Pinwriter • NEC Technologies • 1414 Massachusetts Ave., Boxborough, MA 01729 • (800) 388-8888, (508) 264-8000 • $499

BEST PRINTERS

DOT MATRIX PRINTERS

Rank	Product	Pros and Cons	Price * 30%	Performance 25%	Configuration 15%	Output quality 10%	Documentation 5%	Ease of installation 5%	Ease of maintenance 5%	Service and support 5%	Total Score
1 PC Magazine BEST	**Citizen GSX-240** Citizen America Corp. 2450 Broadway, Suite 600 Santa Monica, CA 90411 (800) 477-4683 $519	**Pros:** Easy to use; versatile paper handling; very quiet operation. **Cons:** Relatively expensive.	8.1	9.2	9.6	8.4	10.0	10.0	9.5	8.1	**88.8**
1 PC Magazine BEST	**NEC Pinwriter** NEC Technologies 1414 Massachusetts Ave. Boxborough, MA 01719 (800) 388-8888 $499	**Pros:** Speedy; great-looking output; easy to maintain. **Cons:** Less extensive features.	8.3	9.9	7.6	8.9	8.4	10.0	10.0	9.4	**88.8**
3	**Star NX-2430 Multi-Font** Star Micronics America 420 Lexington Ave. New York, NY 10170 (800) 447-4700 $399	**Pros:** Very easy to install; scalable fonts. **Cons:** Not especially quiet.	9.0	8.4	8.6	8.9	9.5	10.0	9.0	8.7	**88.5**
4	**Panasonic KX-P2124** Panasonic Office Automation Two Panasonic Way Secaucus, NJ 07094 (800) 742-8086 $550	**Pros:** Speedy; easy to use; excellent documentation; very quiet operation. **Cons:** Relatively expensive.	7.9	9.4	8.1	8.2	10.0	9.4	9.5	9.4	**86.7**
5	**Brother M-1324L** Brother Int'l 200 Cottontail Lane Somerset, NJ 08875 (800) 284-4357 $399	**Pros:** Speedy and easy to use; attractive price. **Cons:** Below-average service and support.	9.0	8.9	8.5	8.0	7.9	8.7	8.0	7.4	**86.3**
6	**Epson LQ-570** Epson America 20770 Madrona Ave. Torrance, CA 90503 (800) 289-3776 $499	**Pros:** Versatile paper handling; high-quality output; two-year warranty. **Cons:** Relatively difficult to install.	8.3	8.7	9.0	8.7	8.4	6.9	9.0	10.0	**85.8**
6	**Citizen GSX-230** Citizen America Corp. 2450 Broadway, Suite 600 Santa Monica, CA 90411 (800) 477-4683 $399	**Pros:** Quiet; easy to use; excellent paper handling; good price. **Cons:** Lacks scalable fonts.	9.0	8.4	8.4	8.2	9.5	8.1	8.0	8.1	**85.8**
8	**Epson ActionPrinter 3250** Epson America 20770 Madrona Ave. Torrance, CA 90503 (800) 289-3776 $269	**Pros:** Compact size; very low price; two-year warranty. **Cons:** Below-average speed.	10.0	6.2	9.5	8.2	8.4	8.7	7.0	10.0	**84.9**
9	**Tandy DMP 302** Tandy Corp. One Tandy Center Fort Worth, TX 76102 (817) 390-3011 $499	**Pros:** Fast; nice-looking output. **Cons:** Relatively expensive; below-average service and support.	8.3	9.2	8.7	8.9	7.4	8.1	8.0	5.5	**84.2**
10	**IBM PPS II 2390** Lexmark Int'l 740 New Circle Rd. Lexington, KY 40511 (800) 358-8575 $499	**Pros:** Good feature set; excellent service and support. **Cons:** Output quality below average.	8.3	8.4	8.6	7.6	7.9	7.5	8.5	10.0	**83.4**
11	**AMT Accel-242** Advanced Matrix Technology 765 Flynn Rd. Camarillo, CA 93012 (800) 992-2264 $529	**Pros:** Select-dial front-panel control. **Cons:** Relatively expensive.	8.1	8.1	8.6	8.7	8.4	7.5	9.5	8.7	**83.1**
12	**Star NX-2420 Rainbow** Star Micronics America 420 Lexington Ave. New York, NY 10170 (800) 447-4700 $499	**Pros:** Color comes standard; speedy. **Cons:** Front panel less informative than other printers.	8.3	8.6	7.4	8.0	8.4	8.7	7.0	8.7	**81.8**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

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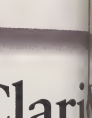
Circle 143 on reader service card.

The Way
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oftware
u To Work.

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LOW-COST COLOR PRINTERS

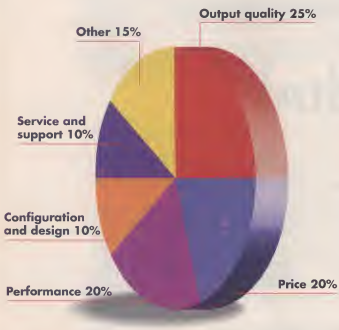
Color printing that makes business sense

The business world can finally be colorized—to a certain extent. Thanks to the price drop in thermal wax-transfer printers and to print-quality improvements in color ink jets, color finally makes sense as a business solution, especially for graphics. What we'd really like to see, though, is one printer that does black-and-white pages as fast as a laser and also delivers color on demand. This printer doesn't exist yet, but by the end of the year we should see fast, color-capable ink jet printers and pricey desktop color lasers that will fill the bill.

The color printers tested for the *PC/Computing* 200 won't replace your 300-by-300-dot-per-inch laser—they don't have the print quality or the speed for monochrome pages. But with list prices below $5,000, they could be affordable as a supplemental printer. We looked at 11 thermal wax-transfer and color ink jet printers, including PostScript, PCL, and dumb printers. Two other color technologies—solid ink and dye sublimation—were priced above our $5,000 cap. By press time, however, solid-ink-printer prices had dropped below that limit. All 7 of our winners print at 300-by-300-dpi resolution.

DECIDING FACTORS

Superb color output tops the list of requirements, but performance and price must also be acceptable.



Factors and Weights

Output quality is the most important factor in selecting a color printer, so it accounts for 25 percent of the overall score. Currently, printing with color means paying more and sacrificing speed for a device that excels at providing only a few kinds of documents. For that compromise to be acceptable, the output must be up to business standards. But while buyers should be prepared for a trade-off in **price** and **performance,** these factors are still undeniably important, so each counts for 20 percent.

The **configuration and design** score of 10 percent reflects the amount of memory, number of fonts, and types of ports the printer includes; the space it takes up on a desktop; and whether the printer provides business-quality output on plain paper. Considering the high prices in this category, **service and support**—at 10 percent—is an especially important consideration.

We assigned **documentation, ease of installation,** and **ease of maintenance** weights of 5 percent each because these factors help determine how convenient the printer will be to use. Most of us have less experience with color ribbon rolls and ink cartridges than with toner cartridges, so clear documentation is a must.

How We Tested

ZD Labs tested performance by printing a variety of typical documents that a color printer user would be likely to print. The test files included a color business presentation created in Microsoft PowerPoint and several scanned TIFF images produced in Aldus PhotoStyler. The technicians also printed samples using a variety of print media, including glossy or coated paper, plain paper, and transparencies.

Next, we compared the documents to judge the overall quality of their business graphics. We also examined the print samples for dithering quality (the finer the dot pattern, the better) and for color matching (the closer the printer colors are to the original, the better).

PC/COMPUTING DECISION MAKER

How to buy the low-cost color printer that's best for your business.



PC Computing BEST

LOW-COST COLOR PRINTER

ColorMaster Plus 6603 PS wins the blue ribbon.

The best all-around color printer we tested was the CalComp ColorMaster Plus, proving that thermal wax transfer can deliver outstanding quality and fast performance at a reasonable price. The ColorMaster Plus prints superb documents with vibrant color and a minimally distracting dot pattern. Blended fills show good color range without banding or streaking. This printer isn't the fastest, but it did our samples in good time. For an affordable color printer with excellent output quality, ColorMaster Plus can't be beat.

ColarMaster Plus 6603 PS • CalComp • 2411 W. La Palma Ave., Anaheim, CA 92801 • (800) 932-1212, (714) 821-2000 • $3,995



BEST PRINTER
LOW-COST COLOR PRINTERS

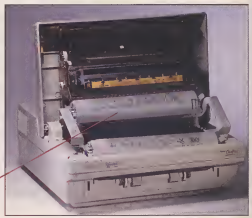
Rank	Product	Pros and Cons	Output quality 25%*	Performance 20%	Price 20%	Configuration 10%	Service and support 10%	Documentation 5%	Ease of installation 5%	Ease of maintenance 5%	Total Score
1 BEST	**ColorMaster Plus 6603 PS** ColComp 2411 W. La Palma Ave. Anaheim, CA 92801 (800) 932-1212 (714) 821-2000 $3,995	**Pros:** Excellent print quality; fast printing; low price for thermal printer. **Cons:** Supports only PostScript Level 1.	9.8	9.6	8.2	8.7	10.0	8.8	10.0	8.3	**92.4**
2	**Canon BJC-800** Canon Computer Systems 123 E. Paularino Ave. P.O. Box 5048 Costa Mesa, CA 92628 (800) 848-4123 $2,795	**Pros:** Best output quality; prints on plain paper; low price. **Cons:** Slow printing.	10.0	7.9	8.9	8.1	9.0	10.0	10.0	9.1	**90.3**
3	**ColorScript 210** QMS One Magnum Pass Mobile, AL 36618 (205) 633-4300 $4,995	**Pros:** Excellent business graphics print quality; fast printing. **Cons:** High price; no toll-free tech support.	9.7	9.8	7.6	9.1	7.6	8.8	7.6	8.6	**88.3**
4	**SII Personal ColorPoint PSE** Seiko Instruments USA 1130 Ringwood Court San Jose, CA 95131 (800) 888-0817 $3,599	**Pros:** Good overall print quality; low price for thermal printer. **Cons:** Bare-bones features.	9.2	9.5	8.4	8.2	8.1	8.8	7.6	8.6	**87.6**
5	**Phaser 200e** Tektronix P.O. Box 1000 Wilsonville, OR 97070 (800) 835-6100 (503) 682-7377 $4,190	**Pros:** Fastest color printer; prints on laser paper. **Cons:** Unexceptional print quality; below-average ease of maintenance.	8.4	9.9	8.1	9.4	8.5	8.8	8.8	7.4	**87.4**
6	**IBM Color Jetprinter PS4079** Lexmark Int'l 740 New Circle Rd. Lexington, KY 40511 (800) 358-5575 (606) 232-2000 $3,495	**Pros:** PostScript ink jet printing; prints on plain paper. **Cons:** Slow printing; poor documentation.	9.1	8.3	8.5	9.1	10.0	5.3	7.6	9.4	**86.6**
7	**PaintJet XL300 PostScript** HewlettPackard MS 511LSJ P.O. Box 58059 Santa Clara, CA 95051 (800) 752-0900 $4,995	**Pros:** Good print quality on plain paper; internal network interface options. **Cons:** Slow printing; expensive.	9.2	7.4	7.6	9.3	8.1	10.0	8.8	9.1	**84.4**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

No-mess transfer-roll replacement.

Removing thermol transfer ribbon rolls is o poin. The colored ribbon wrinkles or rolls owoy when you set it down on o toble. Seiko includes o ribbon tray with the **Seiko SII Personal ColorPoint PSE** thot keeps the ribbon neot ond stotionary while you're cleoring poper joms. Instolling the ribbon in the tray tokes o couple of extro minutes, but if you frequently switch from three-color to four-color ribbon rolls, or need to remove the ribbon to cleor poper joms, it's worth the effort.



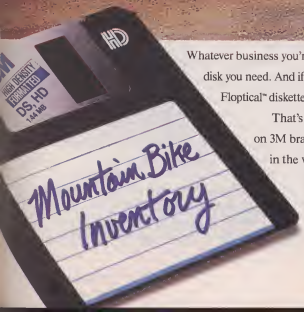
Ribbon transfer tray



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3M *Reliability*

Circle 163 on reader service card.

Picture Perfect

The best graphics cards and displays for speedy

VGA is dead. So are cramped 14-inch low-resolution monitors. Windows killed them both.

Run Windows and OS/2 applications in VGA mode, and its shortcomings are obvious—fonts are jagged, spreadsheets can display only a few columns, and graphics appear grainy or washed out. And working with more than one window open in VGA mode is practically impossible.

For offices that have standardized on Windows, enhancing a PC's video capabilities can pay off now with improved productivity and performance (see "Big Monitors, Small Prices," below). We selected the best products for business users in six video categories, three each in the display and video adapter categories.

Accelerate

Adding a video accelerator to your system can be the cheapest, easiest way to boost graphics performance. With prices as low as $100 for basic accelerators, these cards are hard to resist. On the other hand, you can spend a thousand dollars or more on a professional-quality true-color card.

For mainstream business applications, low-cost Windows accelerators are the best buy around. They offer resolutions of up to 1,024 by 768 at flicker-free screen refresh rates and sport list prices of under $500.

Low-cost accelerators do an excellent job with text-based applications, but for graphical apps that require more processing muscle (and more color), you should consider high-resolution accelerators. Boards in this class cost $500 and up, but they're the fastest around and they support 1,280-by-1,024 resolution (though you'll need a 17- or 20-inch monitor). Because they typically come with 2MB or more of memory, many can also display 16-bit color for near-photo-quality images at 1,024-by-768 resolution—ideal for viewing presentations and scanned color images.

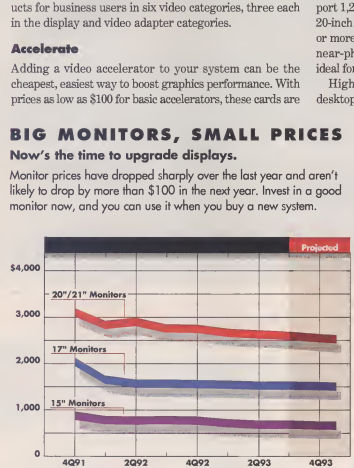
High-resolution true-color cards are best for color desktop publishing, color graphics and illustration, photo retouching, and other color work. Boards in this category cost between $700 and $3,000, depending on the processor chip and the amount of onboard memory.

We only considered ISA boards, which offer the largest selection and best prices. Recently, however, VESA local-bus and low-cost EISA versions of many of the boards we tested have become available. If you own or plan to buy a local-bus or EISA PC, consider these other architectures; they offer better performance than their ISA counterparts.

BIG MONITORS, SMALL PRICES

Now's the time to upgrade displays.

Monitor prices have dropped sharply over the last year and aren't likely to drop by more than $100 in the next year. Invest in a good monitor now, and you can use it when you buy a new system.



SOURCE: MONITRAK QUARTERLY, STANFORD RESOURCES

What Price Performance?

After deciding the type of card you want, you need to consider: graphics chips, memory, image quality, and drivers—all of which affect the board's price tag.

Graphics chips The most significant factor in a board's performance (and price) is the graphics chip it uses. There are three general types of graphics chips: dumb frame buffers, fixed-function processors (also called accelerators), and coprocessors. Older VGA cards typically use dumb frame-buffer chips,

Video

video performance

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which simply send everything to the CPU for processing. The newer fixed-function cards use accelerator chips with built-in graphics smarts. These chips handle common Windows graphics tasks (such as resizing windows and scrolling), thereby freeing the CPU for other tasks. Consider this kind of card first. A third kind of chip, graphics coprocessors such as the Texas Instruments TI 34020, are found primarily on true-color cards and can be programmed by software applications to perform certain graphics tasks. Eight of the 13 true-color cards we tested use TI 34020 chips. Although coprocessors were once the fastest chips around, many boards using fixed-function accelerators are now just as fast. (See "Chips for Every Graphics Task" page 220.)

TRINITRON MONITORS: THE SHARPER IMAGE

Trinitron's edge: precise color alignment.

It costs a bit more, but Trinitron's one-gun three-beam display technology and aperture grille with unbroken slits deliver the sharpest focus and rich, bright colors.



Three separate guns fire beams of electrons, focused through three separate lenses, at a metal shadow mask.

Holes in the shadow mask align the electron beams so that each strikes only a single round phosphor.

The beams strike red, blue, and green phosphors on the inside of the monitor's screen. The phosphors are arranged in a triangle formation, which makes it difficult to control the alignment of the three colors.



Three electron guns fire beams of electrons through a single lens.

A grille of continuous, vertical slots aligns the electron beams as the conventional monitor's shadow mask does, but the mask allows more light from each of the beams to pass through, creating a brighter image.

The beams strike red, blue, and green rectangular phosphors on the inside of the monitor's screen. The phosphors are arranged in a row, resulting in more precise vertical alignment of the colors.

Memory Boards that use video RAM (VRAM) are typically faster and more expensive than those using dynamic RAM (DRAM). Memory also determines color support: You need a card with 1MB of memory to display 8-bit color (256 colors) at 1,024-by-768 resolution, and 2MB of memory to display 16-bit color (65,536 colors) at the same resolution. True-color cards generally require 3MB to 4MB to display 24-bit color (16.7 million colors) at 1,024 by 768. Though some true-color cards allow you to add up to 40MB of additional DRAM for font caching and loading large image files, there's currently no advantage under Windows to having more than 4MB of memory on a card.

Image quality Higher resolutions require higher refresh rates to produce an acceptable image. Any board you buy should support refresh rates of at least 70Hz (72Hz or higher is better) at all resolutions you plan to use. At lower refresh rates, the image will shimmy and flicker. Also, monitors that use interlacing produce no-

Chips for Every Graphics Task

The graphics accelerator determines a video card's price and performance.



S3 86C911, 924, 801

Type: Fixed-function processors.
Board price: $200 to $1,300.

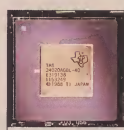
Pros: Excellent mainstream Windows accelerator chips; economical true-color acceleration on high-end boards.
Cons: Average DOS performance.



S3 86C928

Type: Fixed-function processor.
Board price: $300 to $900.

Pros: High-performance Windows acceleration; ideal for graphics-intensive applications and high resolutions.
Cons: Expensive.



Texas Instruments TI 34020

Type: Programmable coprocessor.
Board price: $800 to $3,000.

Pro: Heavy-duty processing for color-sensitive true-color graphics work, desktop publishing, and CAD.
Cons: Most expensive chip available.



IIT AGX014

Type: Fixed-function processor.
Board price: $300 to $600.

Pros: High-performance Windows acceleration; ideal for graphics-intensive applications and high resolutions.
Cons: Expensive; lackluster DOS performance.



Western Digital WD90C31

Type: Limited fixed-function processor.
Board price: $150 to $450.

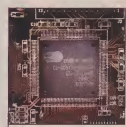
Pros: Economical Windows acceleration for mainstream business applications (word processing, spreadsheets); good DOS performance.
Cons: Limited color support.



ATI 68800 (Mach 32)

Type: Fixed-function processor.
Board price: $500 to $900.

Pros: Dramatic performance improvement in Windows and DOS applications; accelerates 16-bit color at 1,024 by 768.
Cons: Expensive.



Cirrus Logic CL-GD5422, CL-GD5426

Types: Limited fixed-function processor.
Board price: $100 to $300.

Pros: Economical Windows acceleration for mainstream desktop systems; good DOS performance.
Cons: Limited color support.



Tseng ET4000

Type: Dumb frame buffer.
Board price: $50 to $150.

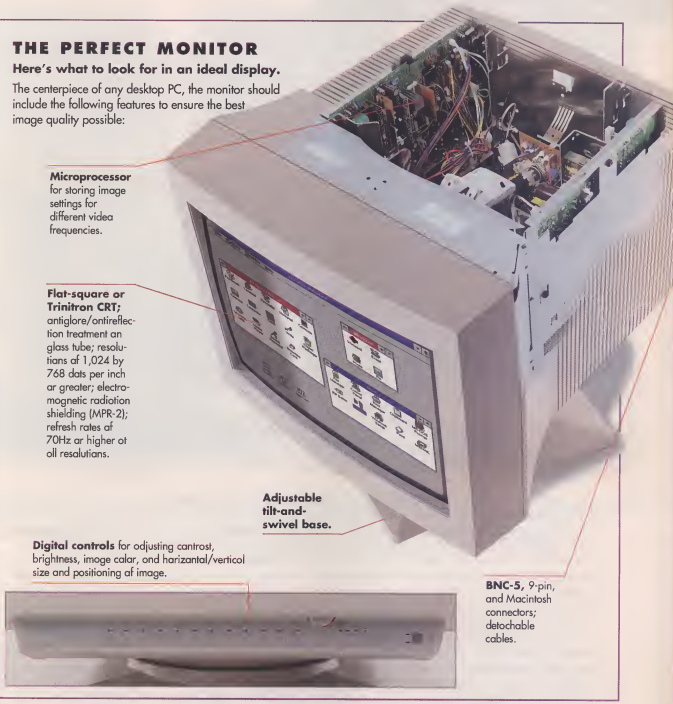
Pros: Inexpensive chip for running DOS-based applications at VGA resolution.
Cons: No onboard video acceleration; sluggish Windows performance.

PHOTOGRAPHS BY ERNE FREDSANGER

THE PERFECT MONITOR

Here's what to look for in an ideal display.

The centerpiece of any desktop PC, the monitor should include the following features to ensure the best image quality possible:



PHOTOGRAPHS BY FRED SIMSON. PHOTOILLUSTRATION BY TIMOTHY EDWARD EDWING.

ticeable flicker. All of the 59 cards we tested supported refresh rates of 70Hz or better at most resolutions.

Software drivers The board you buy should include drivers for all the resolutions, applications, and color levels you need. Also investigate a vendor's support plan for its drivers—you'll want to download the newest drivers from the manufacturer's BBS or have them mailed to you.

The Big Picture

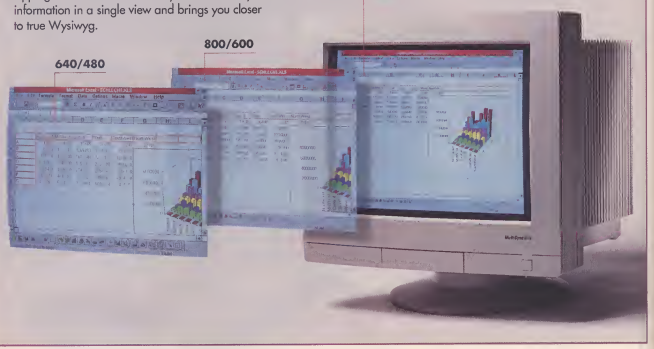
The proper video card is only half the equation for better-looking Windows. To take advantage of any video card, you need a high-resolution mulitfrequency monitor. Generally, your first considerations when you select a monitor should be the size and resolutions you require.

If you run Windows but also use several DOS applications, then 15-inch monitors are an excellent buy (see "Big Monitors, Small Prices," page 218). Since most DOS programs don't run at resolutions higher than 640 by 480, displaying them on anything larger than a 15- or 17-inch monitor makes them appear grainy and stretched. In fact, 15-inch monitors are best suited for 800-by-600 resolution, although they can also handle 1,024 by 768.

MORE ROOM TO VIEW

Higher resolutions give you a bigger, better picture.

Spend less time scrolling around and switching views in Windows. Upping the video resolution on your PC allows you to see more information in a single view and brings you closer to true Wysiwyg.



PHOTOGRAPH BY ERNIE FRIEDLANDER; PHOTOILLUSTRATION BY TIMOTHY EDWARD DOWNS

Seventeen-inch monitors, also called Windows displays, are more expensive than their 15-inch cousins. But if you need to have multiple documents and applications on-screen, they're well worth the price. They're best suited for 1,024-by-768 resolution, though many also support 1,280 by 1,024. Twenty- and 21-inch monitors ably handle detailed illustration, design, imaging, and desktop publishing work, since they display two full pages.

Monitor size, incidentally, can be misleading. The advertised display size refers to the diagonal measure of the monitor's glass screen, or tube—not the size of the image you'll see. The active diagonal display area on 17-inch monitors, for example, ranged from 14 inches to 16.6 inches. Measure the image on the display you plan to buy.

Know Your Monitor Inside and Out

Once you settle on monitor size, you should consider image quality, controls, ergonomics, and design.

Image quality Sitting in front of a monitor that produces barely legible, dim, and unfocused images is excruciating. Monitors that use flat-square or Trinitron tubes typically provide better image quality than those that use conventional, curved tubes (see "Trinitron Monitors: The Sharper Image," page 219). In fact, six of the top eight 20-inch monitors we tested featured Trinitron technology. But image quality is subjective, so it pays to examine a display before you buy. If that's impossible, at least make sure the displays can be returned if the image quality is unacceptable. Pay particular attention to a monitor's focus and the uniformity of its colors.

Controls A monitor's control are key for ensuring that the image can be adjusted. At minimum, a monitor should include controls for adjusting contrast, brightness, and vertical and horizontal size and centering of the image. Better monitors also include controls for adjusting color, barreling, pincushioning, and more (see "The Perfect Monitor," page 221). All of the monitors in the *PC/Computing* 200 include precise digital controls, and many also include microprocessor-based controls for saving image settings for different video signals in memory. This is handy when you're switching from DOS in VGA resolution to Windows in 1,024-by-768 resolution.

Ergonomics and design Any monitor you consider should support noninterlaced refresh rates of 70Hz or higher at the resolutions you plan to use. Anything less produces annoying flicker. Also important is a tilt-and-swivel base for sturdiness. Rap the monitor sharply; the image should remain stable or recover quickly.

We found 44 products in six video categories that met our standards. The ideal office is likely to mix and match across categories to keep budgets in line and users happy.











Which monitor offers all of these features together? Only the new Toshiba OmniSync™ CW.

The newest 17" OmniSync™ monitors from Toshiba feature our renowned Flat Square II CRT with revolutionary anti-reflective coating. This unique new coating provides exceptional contrast ratio and picture black, while providing full MPR II compliance.



For more information on the new OmniSync CW and CT — high-resolution monitors with a full set of features not available together anywhere else — call **(800) 253-5429, ext. 321.**

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Circle 206 on reader service card.

LOW-COST VIDEO CARDS

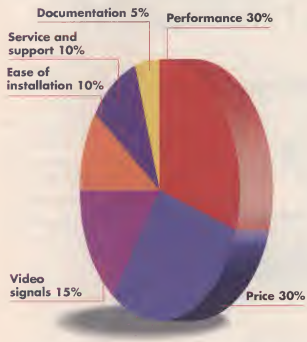
Fast, high-resolution graphics for under $500

If you're waiting more than working in Windows, don't blame your CPU—the real culprit may be your system's video adapter. The newest breed of low-cost Windows accelerators delivers video performance several times better than that from a conventional frame-buffered VGA card. Designed to process common Windows graphics instructions with an onboard, fixed-function processor chip, they speed Windows performance by leaving your CPU free for other tasks. And with average list prices in the $150-to-$300 range—the same range as for traditional Super VGA cards without acceleration features—you get added speed at no additional cost.

For consideration in this category, video adapters had to support resolutions of 1,024 by 768 pixels at 256 colors in noninterlaced modes, and refresh rates of 70Hz or higher at this resolution (at lower refresh rates this resolution is unusable due to flicker). We also wanted boards configured with 1MB of memory—needed to display 256 colors at 1,024 by 768—and that included a fixed-function accelerator chip for speeding graphics functions. All the boards we considered are ISA adapters, though EISA and VL-Bus versions of many of these boards are just now hitting the street. The final selection criterion was price: We considered only boards with list prices under $500. In all, 39 boards qualified for testing and 10 achieved top scores.

DECIDING FACTORS

With low-cost video cards, price and performance account for about two-thirds of the score.



Factors and Weights

Performance—how well a board handles text and graphics-intensive applications under Windows—accounts for 30 percent of the final score in this category. Tests were weighted to emphasize everyday graphics functions such as text scrolling and screen redraws. **Price** was considered an equally important factor and is worth 30 percent of a card's score.

The more resolutions and colors a video card supports, the more flexibility it offers—and the more likely that it will work with any monitor. For this reason, the **video signals** supported contributes 15 percent of a monitor's score. Extra points go to cards with refresh rates higher than 72Hz at 640 by 480 resolution and 1,024 by 768, since this translates into better image quality and minimal flicker. Scores for **service and support** and **ease of installation** are worth 10 percent of the total, while the score for **documentation** contributes 5 percent.

How We Tested

ZD Labs ran all the cards through a series of tests using real-world business applications, including Microsoft Word for Windows 2.0, Excel 4.0, and CorelDraw 3.0. All the boards ran at 1,024-by-768 resolution displaying 256 colors for the Windows tests.

ZD Labs conducted benchmark tests to determine how well the cards performed at 640-by-480 VGA resolution under DOS, though this accounted for only 20 percent of a card's total performance score. ZD Labs also evaluated the cards' ability to handle different resolutions, ensuring compatibility with different video signals. All the boards were tested on identical 33MHz 486DX systems with 16MB of RAM and a 124MB hard drive.

PC/COMPUTING DECISION MAKER

How to buy the low-cost video card that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Performance	Price	Video signals	WindowsVGA 24 8500
		Ease of installation	Edge D24 BitBlaster Plus
	Video signals	Service and support	Volante Warp10
		Ease of installation	Metheus Premier 53
Price	Service and support	Performance	Videa Seven WIN.VGA
		Ease of installation	Sigma Legend 24LX
	Ease of installation	Performance	Edge D24 BitBlaster Plus
		Documentation	Sigma Legend 24LX
Video signals	Price	Service and support	Sigma Legend 24LX
		Ease of installation	Sigma Legend 24LX
	Service and support	Performance	Valante Warp10
		Ease of installation	Sigma Legend 24LX

PC Computing BEST

LOW-COST VIDEO CARD

Sigma's Legend 24LX does it all.

The Legend 24LX isn't the fastest board, but at $169 it offers o great balance of price, performance, and features. Built around the Cirrus Logic 5422 accelerotor chip, the Legend 24LX supports 72Hz refresh rates at 1,024 by 768, which means flicker-free images at that resolution. The Legend's software drivers are well written, too; it outperformed five other cards using the identicol chip. Another nice touch is the MultiMode Control Panel utility, a Windows program that lets you switch the Legend's resolutions and color depth under Windows



Legend 24LX • Sigma Designs • 47900 Bayside Pkwy., Fremant, CA 94538 • (800) 845-8086, (510) 770-0100 • $169

"Ami Pro 3.0...ups the ante in the fight among the Big Three: Ami Pro, Microsoft Word 2.0 and WordPerfect for Windows. It's full of clever features that make your work easier and faster."

BYTE 9/92

"In the Windows word processing world, Ami Pro 3.0 comes close to being perfect ...It stands above Word and WordPerfect both in its function and in its speed."

Home Office Computing 1/93

Software Digest **RATINGS REPORT**®

The Independent Comparative Ratings Report for Selecting IBM PC Business Software

Vol.9, #6, September 1992

Advanced Word Processors for Windows	
	Overall Evaluation
1ST **Ami Pro 3.0 for Windows**	**8.7**
2ND Word for Windows 2.0	8.1
3RD WordPerfect 5.1 for Windows	6.1

"Ami Pro 3.0 takes the le as the Windows wo

If you're still under the impression that Microsoft® Word and WordPerfect® are the top dogs in the word processing arena, we've got news for you.



According to the top reviewers, and people who've tried it, Lotus® Ami Pro® 3.0 is far and away the Windows™ word processor of choice. In fact, it's becoming increasingly clear with each new release, that Lotus is the developer of choice for Windows applications.

Ami Pro wins the war of the words.

Simply put, Ami Pro is a faster, easier, friendlier word processor to use. It does so many things with so little effort, most people never even bother to open the manual.

To name a few, there's real, no ifs-ands-or-buts WYSIWYG. There's Fast Format, for quick repetition of text formats. And, there are customizable, editable SmartIcons™ that give you instant, one-click access to most tasks.

There's also automatic renumbering of lists. Preview of Style Sheets. QuickStart online tutorial. Free 24 hour a day technical support.* And to ease your mind, a 60-day money back guarantee.

Computing MVP WINNER

Windows Sources RECOMMENDED PRODUCT

1992 BYTE AWARD OF DISTINCTION

Ami Pro has won every major award in its category.

Software Digest, Ratings Report, Vol. 9, #6, Sept 1992. Among all word processors tested. Reprints available upon request. *On weekdays, plus 7AM to 4PM on Saturdays. **Offer expires 9/30/93. Call for a list of eligible word pro

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"Ami Pro is the best word processor on the market... [it] goes the competition one better in every respect."

PC/Computing 12/92

"Ami Pro 3.0 provides a host of new and enhanced features...that save time and make your work easier."

Windows Magazine 2/93

"Ami Pro Version 3.0... is the most graphical, colorful and in many ways the most powerful word processor on the market...no other package can match its ambition, its range of functions or the sheer pleasure of using it."

PC Magazine 1/93

"You can learn to use Ami Pro... in about a day. Put the manual in a drawer as a first step. There are no required control codes, no deeply nested menus, no command words. This friendliness greatly expands and sharply changes the market."

Forbes 2/93

ad over Microsoft Word
rd processor to beat."

InfoWorld 9/28/92

Have we convinced you to switch yet?

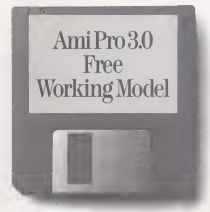
If you're switching from WordPerfect for

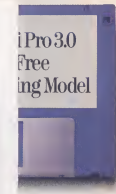
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Order your FREE, full-featured working model of Ami Pro 3.0, rated the number one word processor for Windows. And see for yourself why over a million people have already chosen Ami Pro. Just complete and mail this card or call **1-800-872-3387, ext. 8761.** Offer expires 9/30/93.*





Name:

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My disk format is: ☐ 3½" ☐ 5¼" Do you currently own a word processor? ☐ Yes ☐ No

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"Ami Pro 3.0...ups the ante in the fight among the Big Three: Ami Pro, Microsoft Word 2.0 and WordPerfect for Windows. It's full of clever features that make your work easier and faster."

BYTE 9/92

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If you're still under the impression that Microsoft® Word and WordPerfect® are the top dogs in the word processing arena, we've friendlier word processor to use. It does so many things with so little effort, most people never even bother to open the manual.



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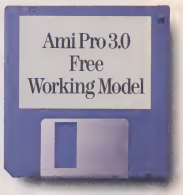
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See for yourself. For free.

What drives hardened reviewers to use words like "love" and "pleasure" when describing Ami Pro?

Call us for a free working model and see for yourself.

If you're like more than a million other people, once you actually sit down with Ami Pro, you'll definitely choose it. Over Word. Over WordPerfect. Over every other word processor out there.



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Lotus Ami Pro 3.0

Word Processor for Windows

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BEST VIDEO

LOW-COST VIDEO CARDS

Rank	Product	Pros and Cons	Performance 30%*	Price 30%	Video signals 15%	Ease of installation 10%	Service and support 10%	Documentation 5%	Total Score
1	**Legend 24LX** Sigma Designs 47900 Bayside Pkwy Fremont, CA 94538 (800) 845-8086 (510) 770-0100 $169	**Pros:** Superb all-around value; Windows resolution and color configuration utility. **Cons:** Not the fastest board.	8.6	9.4	9.8	9.0	9.3	9.3	**91.7**
2	**WindowsVGA 24 Model 8500** Genoa Systems 75 E. Trimble Rd. San Jose, CA 95131 (408) 432-9123 $179	**Pros:** Standout performance at a great price. **Cons:** Supports only 70Hz refresh rates at 1,024-by-768 resolution.	9.2	9.3	8.6	8.5	8.5	8.9	**89.9**
3	**WIN.VGA** Video Seven 4305 Landing Pkwy. Fremont, CA 94538 (800) 238-0101 (510) 656-7800 $189	**Pros:** A snap to install and configure; a price that's hard to beat; a seven-year warranty; toll-free support. **Cons:** Not the fastest board.	8.6	9.2	8.4	8.5	10.0	10.0	**89.5**
4	**GraphicsEngine 32** Actix Systems 3060 Tasman Dr. Santa Clara, CA 95054 (800 927-5557 (408) 986-1625 $199	**Pros:** Good balance of price and performance; upgradable DRAM memory. **Cons:** 70Hz refresh rates at 1,024 by 768; sparse documentation.	8.9	9.1	8.7	8.5	9.3	8.5	**89.1**
5	**Premier S3** Metheus 1600 N.W. Compton Dr. Beaverton, OR 97006-6905 (503) 690-1550 $299	**Pros:** Great performance and upgradable DRAM memory for adding support for 1,280-by-1,024 resolution. **Cons:** Premium price.	9.1	8.2	8.6	10.0	9.6	8.9	**88.9**
6	**SpeedStar 24X** Diamond Computer Systems 1130 E. Arques Ave. Sunnyvale, CA 94086 (800) 949-2345 (408) 736-2000 $229	**Pros:** Fast, affordable, and well supported; ships with Halo Desktop Imager 24-bit image-editing program. **Cons:** Middling documentation and installation scores.	9.2	8.8	8.3	8.5	9.3	8.9	**88.7**
7	**Stealth 24** Diamond Computer Systems 1130 E. Arques Ave. Sunnyvale, CA 94086 (800) 949-2345 (408) 736-2000 $249	**Pros:** Easy to install and well-supported; includes Halo Desktop Imager 24-bit image-editing software. **Cons:** Premium price.	8.9	8.6	8.5	9.5	9.3	8.5	**88.3**
7	**D24 BitBloster Plus** Edge Technology 915 E. Karcher Rd. Nampa, ID 83687 (800) 438-3343 (208) 465-3434 $99	**Pros:** Unbeatable price and first-rate performance. **Cons:** Documentation and service and support could be improved.	9.1	10.0	8.3	9.0	5.6	7.8	**88.3**
9	**Novo True Color** Rocket Technologies 222 Wall St., Suite Z Chico, CA 95928-5487 (916) 899-3000 $140	**Pros:** Great price for above-average performance. **Cons:** Documentation sparse; supports only 70Hz refresh rates at 1,024 by 768.	8.6	9.6	8.0	9.0	8.5	8.1	**88.2**
10	**Valante Warp10** National Design 1515 Capital of Texas Hwy. South Fifth Floor Austin, TX 78746 (800) 253-8831 $299	**Pros:** Outstanding performance for its class; backed by a lifetime warranty and toll-free technical support. **Cons:** Relatively steep price.	9.2	8.2	8.9	8.5	9.6	8.9	**88.1**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

Now Windows is as easy to use as DOS.

Microsoft® Windows™ is capable of great and wonderful things.

But if you're among the many who've traded the frustration of the C: prompt for the graphical confusion of Program Manager, relax.

You're about to discover what half a million delighted DOS™ and network users already know.

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Direct Access searches your disk, gathers your programs into logical groups and builds menu screens just like the one you see at the top of this page.

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That's right. You just load it and forget it.

Whenever you want an application, all you have to do is hit one key.

Or, if you prefer, click one mouse.

The more applications you have on your disk, the more you'll delight in Direct Access.

That's because Program Manager insists on grouping your programs into five arbitrary categories: "Windows Applications," "Non-Windows Applications," "Accessories," "Games" and "Main."

Not very intuitive, eh?

Direct Access, on the other hand, gives you a multitude of utterly sensible program groupings – 17 of them.

And that doesn't count the customized ones you dream up yourself.

What does all this mean to you?

It means you can get to a spreadsheet by simply clicking "Spreadsheet." Summon a word processor by stroking "W." And access a DBMS by selecting, you guessed it, "Database."



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If the only PC you're responsible for is the one on your desk, Direct Access is valuable, indeed.

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Suddenly all of your Windows and DOS users can follow the same quick, convenient route to their applications.

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You can decide for yourself precisely who gets access to which menu items.

And prevent novice users from even *looking* at DOS.

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Which you can access directly, 24 hours a day.





FIFTH GENERATION SYSTEMS, INC

Circle 121 on reader service card.

HIGH-RES VIDEO CARDS

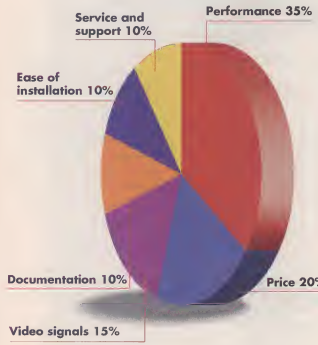
Cards that push the Windows speed limit

Almost every video card now features better-than-VGA resolutions of 800 by 600 and 1,024 by 768 pixels. A new breed of Windows accelerators, however, pushes the bounds of resolution to support the ultrahigh 1,280-by-1,024 resolution at flicker-free noninterlaced refresh rates. Emphasizing performance over price, these display adapters require a 17-inch or 20-inch monitor to take advantage of their maximum resolution. With their amazing speed, they're the ultimate Windows video cards.

To qualify, cards had to support a 1,280-by-1,024 resolution in noninterlaced mode at a 70Hz or higher refresh rate. (Several low-cost cards claim support for 1,280-by-1,024 resolution, but none do so at 70Hz noninterlaced.)

DECIDING FACTORS

Performance is the key buying issue with these video cards, but a wide price range makes cost a factor too.



Additionally, they had to be able to display at least 16 colors in this mode, though many support more. All the cards sync up to 1,024-by-768, 800-by-600, and 640-by-480 resolutions, and many also support 16-bit color at all of these resolutions. Memory varied from 1MB to 3MB, with most cards including 2MB of RAM.

The final requirement was that the cards have a processor or coprocessor for accelerating Windows graphics functions. All the products we considered are ISA adapters, though EISA and VESA local-bus versions of these cards are now available.

Factors and Weights

Speed is critical in this category, so 35 percent of each product's score depends on its **performance**—how well a card handles text and graphics under Windows and (to a lesser extent) under DOS. With list prices ranging widely, **price** (20 percent), is a key factor in determining rank. Prices listed are for the configurations tested.

The more resolutions and colors a video card supports, the more flexibility it offers—and the more likely it is to work with any monitor. For this reason, **video signals** supported accounts for 15 percent of a monitor's total score. Higher scores go to cards that offer more than 256 colors at various resolutions and those that have refresh rates of 72Hz and higher at all resolutions, since this translates into better image quality and minimal flicker. Contributing 10 percent of each product's total score are **service and support, ease of installation,** and the quality of the accompanying **documentation.**

How We Tested

ZD Labs ran all the accelerators through a series of performance tests using real-world business applications, including Microsoft Word for Windows 2.0, Excel 4.0, and CorelDraw 3.0. All of the cards were tested on identical 33MHz 486DX systems with 16MB of RAM and a 124MB hard drive. They were tested at 1,024-by-768 resolution (256 colors) as well as at 1,280-by-1,024 resolution for the Windows performance tests.

ZD Labs also conducted its PC Bench test to determine how well the cards performed at 640-by-480 VGA resolution under DOS; that test result accounted for 20 percent of a card's performance score. ZD Labs also evaluated the cards' ability to handle different resolutions to ensure compatibility with different video signals.

PC/COMPUTING DECISION MAKER

How to buy the high-res video card that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Performance	Price	Video signals	MicroStep AGC-2075 Plus
		Ease of installation	Metheus Premier 928
	Video signals	Service and support	Number Nine #9GXE
		Ease of installation	Number Nine #9GXE
Price	Service and support	Performance	Metheus Premier 928
		Ease of installation	Diamond Stealth Pro
	Ease of installation	Performance	Metheus Premier 928
		Documentation	ATI Graphics Ultra Pro
Video signals	Price	Service and support	Diamond Stealth Pro
		Ease of installation	ATI Graphics Ultra Pro
	Service	Performance	Number Nine #9GXE
		Ease of installation	ATI Graphics Ultra Pro

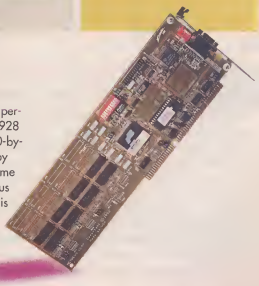
PC Computing BEST

HIGH-RES VIDEO CARD

Metheus's Premier 928: price plus performance.

The Metheus Premier 928 offered the best balance of features and performance in its category at a competitive $699 price. The Premier 928 includes 2MB of onboard VRAM and supports 256 colors at 1,280-by-1,024 resolution and up to 65,536 colors (16-bit color) at 1,024 by 768. Installation is a breeze, and Metheus's customer support is some of the best we found during testing. Metheus offers a VESA local-bus version of the Premier as well. Whether speed, price, or resolution is your first priority, the Premier 928 is an excellent buy.

Metheus Premier 928 (2MB version) • Metheus • 1600 N.W. Compton Dr., Beaverton, OR 97006-6905 • (503) 690-1550 • $699



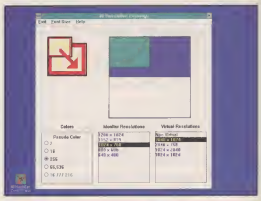
Rank	Product	Pros and Cons	Performance 35%	Price 20%	Video signals 15%	Documentation 10%	Ease of installation 10%	Service and support 10%	Total Score
1 BEST	**Premier 928 (2MB version)** Metheus 1600 N.W. Compton Dr. Beaverton, OR 97006-6905 (503) 690-1550 $699	**Pros:** Stellar performance in both Windows and DOS; good service and support; great price. **Cons:** Limited color support at some resolutions.	9.1	9.2	8.4	9.0	10.0	9.4	**91.3**
2	**#9GXE** Number Nine 18 Hartwell Ave. Lexington, MA 02173 (800) 438-6463 (617) 674-0009 $895	**Pros:** The fastest board in its class; wide range of resolutions and color in 3MB version; hardware pan and zoom. **Cons:** Relatively expensive.	9.5	8.8	9.1	7.4	10.0	8.9	**90.8**
3	**Stealth Pro** Diamond Computer Systems 1130 E. Arques Ave. Sunnyvale, CA 94086 (800) 949 2345 (408) 736-2000 $349	**Pros:** Inexpensive (1MB) but fast; includes Halo Desktop Imager software. **Cons:** Only 70Hz refresh at most resolutions.	8.7	10.0	8.7	8.4	9.1	8.9	**89.9**
4	**Graphics Ultra Pro** ATI Technologies 3761 Victoria Park Ave. Scarborough, Canada M1W 3S2 (416) 756-0718 $799	**Pros:** Easy to install and configure; supports wide range of resolutions and colors. **Cons:** Performance is below average.	7.8	9.0	9.5	10.0	10.0	8.9	**88.5**
5	**AGC-2075 Plus** MicroStep 15358 E. Valley Blvd. City of Industry, CA 91746 (818) 336-8991 $795	**Pros:** First-rate performance; wide range of video signals. **Cons:** Troublesome to install; disappointing support.	9.1	9.0	9.4	9.0	6.3	7.2	**86.5**
6	**Nth Edge 1280** Nth Graphics 1908 Kramer Lane, Suite A Austin, TX 78758 (800) 624-7552 (512) 832-1944 $1,495	**Pros:** Excellent performance; very good technical support. **Cons:** Weak documentation; expensive.	9.3	7.4	7.6	7.9	8.1	9.4	**84.2**
7	**Ropier 8-24** Videologic 245 First St. Cambridge, MA 02142 (800) 578-5644 (617) 494-0530 $1,495	**Pros:** Well-designed; easy to install and configure; excellent range of resolution and color support. **Cons:** Middling performance; expensive.	8.3	7.4	8.0	9.5	10.0	7.8	**83.2**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Switching resolutions is simple with Hawkeye.

Multiple resolutions ond color support in o video cord ore useful only if you con monipulote them easily, and the **Number Nine #9GXE** comes with on excellent Windows utility for doing just thot. Rother thon present you with o list of resolutions and colors, Number Nine's Howkeye utility lets you grophically preview the omount of viewing oreo you goin ot different resolutions. You con olso select from severol "virtuol" resolutions thot expond your desktop up to 2,048-by-2,048 resolution—regordless of whot your monitor supports. In virtuol-resolution modes, your screen octs as a viewport, or window, on on exponded desktop. You move oround the virtuol desktop by ponning your mouse post the screen borders.



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TRUE-COLOR VIDEO CARDS

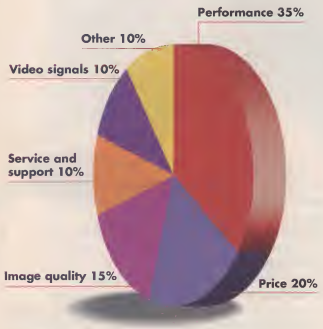
Picture-perfect, professional-quality Windows adapters

Scanned photographs and color photo images don't have to look like faded, grainy approximations of the original when displayed onscreen. High-resolution true-color video cards accurately render lifelike color images and splashy, professional-quality continuous-tone graphics on the PC. Capable of displaying a dazzling 16.7 million colors (also called 24-bit color) at resolutions of 1,024 by 768 pixels or higher, true-color cards are ideal for color-intensive desktop publishing, page layout, photo retouching, color proofs, illustration, and design.

For the *PC/Computing* 200, we considered only cards that supported 16.7 million colors at a noninterlaced resolution of 1,024 by 768 or higher. Several cards displayed a resolution of 1,152 by 870—the near-perfect aspect ratio for two-page desktop publishing. To ensure the best image quality possible, we also required boards to support refresh rates of 70Hz or higher at these resolutions and to have 3MB or 4MB of onboard memory. The boards also had to include an onboard processor to assist the system CPU with graphics tasks and to ensure the fastest performance possible. All the boards are ISA adapters, though EISA and VL-Bus versions are just now becoming available. In all, 14 boards met our criteria; 9 of them made the winners list.

DECIDING FACTORS

The demands of 24-bit color make performance the most important consideration.



Factors and Weights

Speed is crucial when selecting a true-color card, so **performance** accounts for 35 percent of a product's final score in this category. These scores reflect how well a board handles text and graphics-intensive applications under Windows. With list prices ranging from $695 to $3,000, **price**—at 20 percent—comes next on the list of priorities. Because first-rate image quality is key for applications requiring true color, **image quality** contributes 15 percent to a card's overall score. Support for a wide range of video resolutions and colors is also an advantage, so **video signals** accounts for 10 percent. Cards that scored well offer an onboard VGA chip rather than requiring a pass-through connection to a card already in your system. **Service and support** determines 10 percent of a product's final score, while ease **of installation** and the quality of **documentation** are worth 5 percent each.

How We Tested

ZD Labs put the true-color boards through grueling application performance tests. All the boards were tested on identical 33MHz 486DX systems with 8MB of RAM. First ZD Labs tested the boards' text handling under Windows using macros that exercised the boards' scrolling and font handling; they also tested the boards' ability to work with large, heavily formatted documents. The second part of the test evaluated how well a board manipulated and redrew vector graphics, and moved and displayed large, complex 24-bit images in CorelDraw. During this portion of the testing, ZD Labs also assembled a jury of technicians and *PC/Computing* reviewers to evaluate the image and color quality of the video signals produced by all the boards. ZD Labs also evaluated the cards' ability to handle different resolutions to ensure compatibility with different video signals.

PC/COMPUTING DECISION MAKER

How to buy the true-color video card that's best for your business.

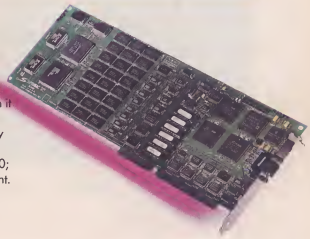
1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Performance	Image quality	Video signals	SuperMac Thunder/24
		Price	Premier 928 (4MB version)
	Video signals	Price	Premier 928 (4MB version)
		Service and support	Volante AT2004
Price	Performance	Image quality	Radius MultiView 24
		Service and support	Premier 928 (4MB version)
	Ease of installation	Service and support	RasterOps PaintBaard PC
		Video signals	RasterOps PaintBoard PC
Image quality	Performance	Video signals	SuperMac Thunder/24
		Service and support	SuperMac Thunder/24
	Video signals	Service and support	SuperMac Thunder/24
		Price	Premier 928 (4MB version)

PC Computing BEST

TRUE-COLOR VIDEO CARD

SuperMac Thunder/24 raises the bar.

Graphics never looked this good on a PC. SuperMac took its own accelerator chip and created the Thunder/24, which offers superb image quality. It was the fastest board we tested, particularly when it came to moving and editing large, 24-bit-color scanned images, and it supports a wide range of 24-bit resolutions—up to 1,152 by 870, the ideal resolution for displaying two full 8.5-by-11-inch pages. A virtual desktop feature ups the resolution to 1,152 by 910; a hardware-based pan and zoom magnifies the image 200 percent.



Thunder/24 • SuperMac Technology• 485 Potrero Ave., Sunnyvale, CA 94086 • (408) 245-2202 • $1,799

BEST VIDEO
TRUE-COLOR VIDEO CARDS

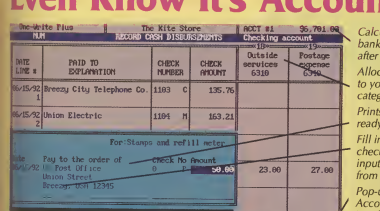
Rank	Product	Pros and Cons	Performance * 35%	Price 20%	Image quality 15%	Service and support 10%	Video signals 10%	Documentation 5%	Ease of installation 5%	Total Score
1 BEST	**Thunder/24** SuperMac Technology 485 Potrero Ave. Sunnyvale, CA 94086 (408) 245-2202 $1,799	**Pros:** Outstanding performance; excellent image quality; 1,152-by-870 two-page resolution. **Cons:** No onboard VGA.	9.7	8.4	10.0	8.7	8.3	7.5	8.7	**90.9**
2	**Premier 928 (4MB version)** Metheus 1600 N.W. Compton Dr. Beaverton, OR 97006-6905 (503) 690-1550 $1,299	**Pros:** Stellar performance at a superb price. **Cons:** Difficult to install; no Windows resolution/color utility.	9.3	9.4	9.0	9.4	8.8	8.1	7.4	**90.8**
3	**MultiView 24** Radius 1710 Fortune Dr. San Jose, CA 95131 (800) 227-2795 (408) 434-1010 $1,499	**Pros:** Gorgeous image quality; easy to install. **Cons:** No onboard VGA; conflicts with other 8514-based VGA adapters.	8.4	9.0	10.0	7.4	7.7	10.0	10.0	**87.5**
4	**PaintBoard PC** RasterOps 2500 Walsh Ave. Santa Clara, CA 95051 (800) 729-2666 (408) 562-4200 $1,299	**Pros:** Great price; excellent service and support; onboard VGA. **Cons:** Lackluster image quality.	8.1	9.4	7.6	10.0	8.7	9.4	10.0	**87.0**
5	**Impression 1024** Matrox Electronic Systems 1055 St. Regis Blvd. Dorval, Canada H9P 2T4 (800) 361-1408 (514) 685-2630 $995	**Pros:** Unbeatable price; strong performance; onboard VGA. **Cons:** Below-average image quality.	8.4	10.0	6.6	9.4	8.5	10.0	7.4	**85.9**
5	**#9GXiTC** Number Nine 18 Hartwell Ave. Lexington, MA 02173 (800) 438-6463 (617) 674-0009 $1,795	**Pros:** Widest range of resolutions/colors and refresh rates; onboard VGA. **Cons:** Average performance.	8.1	8.5	8.5	8.7	9.4	9.4	10.0	**85.9**
7	**Volonte AT2004** National Design 1515 Capitol of Texas Hwy. South, Fifth Floor Austin, TX 78746 (800) 253-8831 $1,995	**Pros:** Good all-around performance and feature set. **Cons:** Mediocre documentation; no Windows configuration utility.	8.5	8.1	8.1	9.4	9.2	7.5	10.0	**85.5**
8	**Chrome (Model C631)** Hercules Computer Technology 3839 Spinnaker Court Fremont, CA 94538 (800) 532-0600 $1,795	**Pros:** Superior image quality; above-average performance. **Cons:** No onboard VGA; below-average vector graphics performance.	8.8	8.5	9.0	8.1	8.2	6.9	7.4	**84.8**
8	**Truevision 1024-XP** Truevision 7340 Shadeland Station Indianapolis, IN 46256-3919 (800) 344-8783 (317) 841-0332 $1,295	**Pros:** Extraordinary price; onboard VGA; solid features and support. **Cons:** Middling performance.	8.1	9.4	8.1	8.7	8.4	9.4	7.4	**84.8**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

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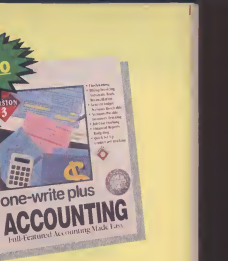
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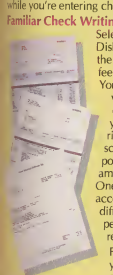
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15-INCH DISPLAYS

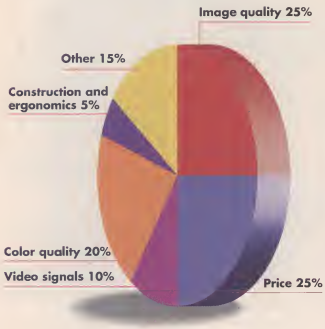
Mainstream monitors that fit on any desktop

Business buyers have discovered that great-looking images come in affordable packages, and 15-inch multifrequency displays are quickly replacing 14-inch VGA displays as mainstream monitors for today's desktop systems. The newest 15-inch models combine the sharp, crisp images and precise image controls of high-end 17-inch models at prices that won't break the budget.

Given the tasks these monitors are likely to perform, we required all 15-inch displays to be multifrequency, which ensured they would work with many different video cards at various resolutions. All the displays we considered support resolutions of 1,024 by 768 pixels (noninterlaced) and a vertical refresh rate of 70Hz or higher to ensure flicker-free images. We also required a 0.28mm or smaller dot pitch to guarantee the best possible focus, and we limited our selection to displays that use flat-square or Trinitron style glass tubes. Digital controls were also required for precise control over image size and location onscreen. We tested 20 monitors that met these criteria; 5 measured up to our standards.

DECIDING FACTORS

Price and image quality tie as the top factors to consider, but color quality counts heavily, too.



Factors and Weights

Since your choice depends mainly on what you see onscreen, **image quality**, which includes focus, contrast, and brightness, accounts for 25 percent of a product's score. Related, but less critical for some applications, is **color quality**, which constitutes 20 percent of the total; the scores for this factor reflect a jury's subjective evaluation. Also high on every shopper's list is **price**, which comprises 25 percent of a display's overall score.

Video signals (10 percent of the total score) rate how well a monitor works with a range of video cards—how it syncs up to different resolutions, the number of programmable video modes it represents, and its bandwidth display and refresh rate. In evaluating **construction and ergonomics** (5 percent), we examined a monitor's controls, the amount of glare it emits, whether it supports the Swedish MPR-2 low-emissions standard, and other design elements. **Service and support** scores (5 percent) reflect the length of a display's warranty and whether it covers both parts and labor. Monitors with microprocessors and sophisticated controls aren't always plug-and-play, which is why **ease of installation** and **documentation** also earn 5 percent each of the total score.

How We Tested

ZD Labs evaluated each monitor's focus, distortion, glare, overall image geometry (whether circles appear round or oval, for example), color convergence, and color saturation. They also tested how well the displays handled different video resolutions. All monitors were tested on identical 33MHz 486 systems using ATI Graphics Ultra Pro accelerator cards. The 11 monitors with the best performance scores went on to the next round.

For the second stage of testing, we asked a panel of six people to rate the focus, contrast and brightness, color quality, and overall ergonomics and design. For this side-by-side test, we ran the monitors at 1,024-by-768 resolution using the ATI 16-bit color driver.

PC/COMPUTING DECISION MAKER

How to buy the 15-inch display that's best for your business.

1. Choose the foctor thot's most important to you.	2. Choose the next most important factor.	3. What else is importont?	4. For your needs, the best product to buy is...
Image quality	Color quolity	Video signols	NEC MultiSync 4FG
		Construction/ ergonomics	Compoq QVision 150
	Construction/ ergonomics	Price	Compoq QVision 150
		Video signols	Nonoo FlexScon F340iW
Price	Image quolity	Color quolity	Compaq QVision 150
		Video signols	ViewSonic 15
	Construction/ ergonomics	Video signols	Compoq QVision 150
		Service and support	Compoq QVision 150
Video signals	Imoge quolity	Color quolity	NEC MultiSync 4FG
		Price	ViewSonic 15
	Price	Construction/ ergonomics	Nonoo FlexScon F340iW
		Service ond support	ViewSonic 15

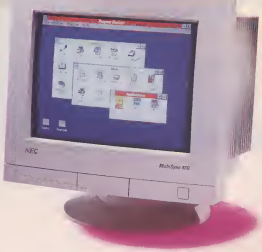
PC Computing BEST

15-INCH DISPLAY

Near-perfection in NEC's MultiSync 4FG.

Perfect scores in five separate tests made the NEC MultiSync 4FG a cinch far the tap spot. Its polished flat-square tube makes for eye-pleasing bright colars and razar-sharp facus an text, even in small paint sizes. The uncluttered frant-panel digital cantrals let yau fine-tune image size, positian, geametry, and even color. Like all af NEC's manitars, the 4FG meets the Swedish MPR-2 law-radiatian standard. NEC's suppart is alsa unparalleled—the campany offers a three-year warranty an all its manitars, including parts and labar.

NEC MultiSync 4FG • NEC Technologies • 1255 Michael Dr., Wood Dale, IL 60191 • (800) 388-8888, (708) 860-9500 • $949



BEST VIDEO
15-INCH DISPLAYS

Rank	Product	Pros and Cons	Image quality* 25%	Color quality 20%	Video signals 10%	Price 25%	Construction 5%	Documentation 5%	Ease of installation 5%	Service and support 5%	Total Score
1 BEST	**NEC MultiSync 4FG** NEC Technologies 1255 Michael Dr. Wood Dale, IL 60191 (800) 388-8888 (708) 860-9500 $949	**Pros:** Finest image quality; beautiful contrast/color saturation; exceptional service and support. **Cons:** Polished gloss tube prone to glare; highest-priced winner.	10.0	10.0	8.7	6.8	7.4	10.0	10.0	10.0	89.4
2	**Compaq QVision 150** Compaq Computer 20555 SH 249 Houston, TX 77070 (800) 345-1518 (713) 370-0670 $793	**Pros:** Rich, vivid colors (deep blacks and bright whites); solid casing. **Cons:** Active display area under 13 inches; some glare.	9.0	9.3	8.6	8.4	8.1	9.3	7.9	9.4	88.1
3	**ViewSonic 15** ViewSonic 20480 Business Pkwy. Walnut, CA 91789 (800) 888-8583 (909) 869-7976 $849	**Pros:** Clean design; straightforward controls; sharp focus on text. **Cons:** More expensive than some 15-inch models.	9.0	9.4	8.8	7.8	8.1	9.0	10.0	8.9	87.6
4	**Optiquest 2000DX** Optiquest 20490 Business Pkwy. Walnut, CA 91789 (909) 468-3750 $645	**Pros:** Least expensive monitor in its class; good overall image quality. **Cons:** Construction flimsy in areas.	8.1	8.3	8.0	10.0	7.3	8.0	7.9	8.3	85.6
5	**Nonao FlexScon F340iW** Nonao USA 23535 Telo Ave. Torrance, CA 90505 (800) 800-5202 (310) 325-5202 $899	**Pros:** Superior focus on text; excellent image controls; unique power-saving features. **Cons:** Colors appear somewhat faded; above-average price.	9.0	7.8	9.5	7.3	8.6	9.7	10.0	8.9	84.5

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Green monitor's energy-saving awareness.

Nanao's FlexScan F340iW has a built-in power-saving feature that senses when your system is powered down. If you forget to turn the monitor off, it simply goes to "sleep," saving the tube and cutting your electric bill. Future versions of the 15-inch and 17-inch monitors (which should be available by press time) can be programmed to sleep after the monitor is idle for a specified amount of time.



Energy-saving sleep mode

"It's a quality desktop replacement... most powerful portable we've seen. One of the lightest units in the entire test group."
– PC Magazine, Mar. '93

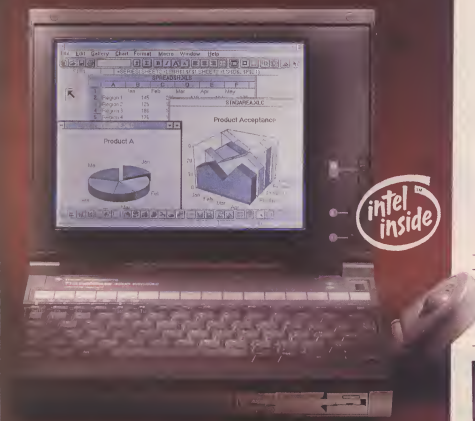
"...in our battery tests, the TI 4000 WinDX2/50 achieved a magnificent 6 hours and 24 minutes."
– Portable Computing, Apr./May '93

"TI has done more to customize and optimize Windows than the other notebook vendors."
– Windows Magazine, Feb. '93

PC MAGAZINE EDITORS' CHOICE
Mar.'93 '93

EXPERTS' Windows SELECTION PICK

PORTABLE COMPUTING MAGAZINE'S PICK



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Win This Super Windows System!



The **DEC 433dx MT System** features Windows performance and Digital-built quality with the expansion you need for LAN servers, multimedia and many other specialized applications and built-in features — all in a compact unit that fits right on top of your desk!



The **Primera Color Printer** delivers rich, vibrant color for stunning presentation graphics and transparencies — all in just over two minutes per page! Includes Microsoft® Windows™ driver.



Contest Rules

To be eligible, return the attached official entry form, or drop at PC/Computing booth #2214 at Spring Comdex. Only fully completed Official Entry Forms will be accepted. (One entry per person).

2. Sweepstakes begin May 17, 1993. Your entry must be received by June 28, 1993. The drawing for the prize will be on June 28, 1993 at PC/Computing's main office in Foster City, CA. All entries become the property of Ziff Davis Publishing Company, which reserves the right to print the name of the winner. The odds of winning depend on the number of entries received by the date given in the official rules and submitted in accordance with the rules.

3. One Grand Prize Winner will be selected in a random drawing from among all entries received under the supervision of PC/Computing's publisher, whose decision will be final. The winner will be required to execute an affidavit of eligibility and release. The winner will be notified by mail. The Sweepstakes will be promoted under the name of PC/Computing Business Solutions Sweepstakes.

You Can Also Drop This at PC/Computing's Spring Comdex Booth No. 2214

Name_____

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Title_____

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PC Computing BUSINESS SOLUTIONS SWEEPSTAKES

How do you usually receive PC/Computing? ❑ Subscription ❑ Newsstand ❑ Trade Shows

Will you be involved in purchasing the following within the next 3, 6 or 12 months?

	Within Next 3 Months	Within Next 6 Months	Within Next 12 Months	Number of Units
Desktop PC	❑	❑	❑	____
Notebook PC	❑	❑	❑	____
Application Software	❑	❑	❑	____
Utility SW	❑	❑	❑	____
Programming SW	❑	❑	❑	____
Entertainment SW	❑	❑	❑	____
Multimedia SW	❑	❑	❑	____
Printer	❑	❑	❑	____
Scanner	❑	❑	❑	____
Multimedia Hardware	❑	❑	❑	____
Storage Device	❑	❑	❑	____
Modem	❑	❑	❑	____
Floppy Disk	❑	❑	❑	____

Thank you and Good Luck with your entry!



Grand Prize: A Super Windows™ Computer System

Place Stamp Here

PCComputing

Attn: Marketing Department
950 Tower Lane
Foster City, CA 94404

Contest Rules Continued...

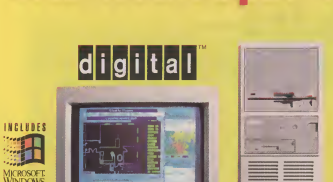
4. PC/Computing will arrange for delivery of all prizes. Any taxes are the responsibility of the winner. Any manufacturer's claims or warranties will apply with regard to any of the prizes. Ziff-Davis is not responsible or liable for any warranty or guarantee either expressed or implied on any prize awarded. No substitutions for prizes.

5. Sweepstakes open to all individuals who are at least 18 years of age and are residents of the United States, its territories and possessions, except employees of Ziff-Davis Publishing or their families, its affiliates and its advertising and promotion agencies. Void where prohibited by law.

6. For the winner's name, send a stamped, self-addressed envelope to: PC/Computing Marketing Department, 950 Tower Lane, Foster City, CA 94404. Prize Winner's name will be available within 10 days of drawing.

7. One Grand Prize Winner will receive a super PC system, including a DEC 425d, HT PC, FARGO Primera Printer, AST, Multi-Spin™ 74 CD ROM, Microsoft Windows™ 3.1, Lotus SmartSuite 3.1 and Improv, and 3M diskettes.

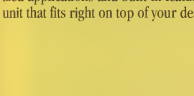
Win This Super Windows System!



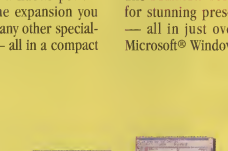
The **DEC 433dx MT System** features Windows performance and Digital-built quality with the expansion you need for LAN servers, multimedia and many other specialized applications and built-in features — all in a compact unit that fits right on top of your desk!



The **Primera Color Printer** delivers rich, vibrant color for stunning presentation graphics and transparencies — all in just over two minutes per page! Includes Microsoft® Windows™ driver.



NEC



Lotus



3M

The **MultiSpin™ 74 Reader** transfers data at a rate of 300 KB/second, supports Kodak's Multisession Photo CD™ technology, is SCSI 2 compatible, has a 256 KB continuous flow cache, and double dust doors and dust brush for added dust protection.

SmartSuite 2.0 is the complete business solution for Windows desktops, including five top-rated applications in one package — Lotus 1-2-3 Release 4 for Windows, Ami Pro 3.0, Freelance Graphics 2.0, cc:Mail and Lotus Organizer.

Improv is the first dynamic spreadsheet for Windows, designed to better address the needs of users who view and analyze information in many different ways.

3M Diskettes — Formatted or unformatted, lifetime warranty. More businesses protect data on 3M brand data storage products than any other brand in the world.

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17-INCH DISPLAYS

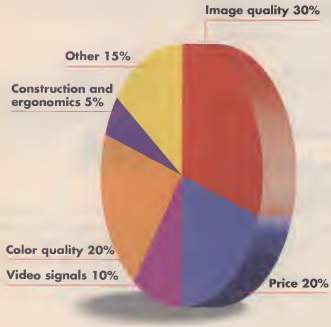
The ideal monitors for serious Windows applications

Serious Windows users shouldn't overlook the importance of a high-quality, high-resolution display. The newest 17-inch multifrequency monitors are ideal for displaying resolutions of 1,024 by 768 pixels (and in some cases higher) without eyestrain, and the added desktop space lets you squeeze nearly 50 percent more information onscreen than you can with a 14-inch VGA display.

We required that this class of displays be able to handle resolutions of 1,024 by 768 at refresh rates of 70Hz or higher (though many of the monitors could display 1,280-by-1,024 resolution as well). To ensure the best image quality possible, we also requested that they include digital controls for adjusting the image onscreen.

DECIDING FACTORS

A winning 17-inch display requires superb image and color quality—at a reasonable price.



All the displays we considered had to have a 0.28mm dot pitch or smaller to guarantee the best focus possible. Additionally, we insisted that they use flat-square or Trinitron-style glass tubes, which minimize glare and image distortion. Twenty-nine monitors met our initial criteria, but only six went on to merit top spots.

Factors and Weights

Image quality—including a display's focus, contrast, and brightness and its ability to display fine lines and small type sizes without losing detail—contributes 30 percent of a monitor's overall score in this category. A related factor, **color quality**, accounts for 20 percent of the total; the score for this factor reflects not only the results of ZD Labs' tests but also a juried panel's evaluation of a monitor's color quality. Also high on the list of considerations for this category is **price**, which accounts for another 20 percent.

At 10 percent of the total, the score for **video signals** measures how well a monitor handles the different video modes, the number of video image settings it stores in memory, its vertical and horizontal refresh rates, and its bandwidth. **Construction and ergonomics** (5 percent) concerns a monitor's controls, its active display area, any problems with glare, overall construction quality, and whether the monitor conforms to the Swedish MPR-2 low-emissions standard. Also rating 5 percent each are **ease of installation, documentation,** and **service and support.**

How We Tested

In evaluating products for this category, ZD Labs subjected all the monitors to a battery of image-quality and resolution tests. Technicians evaluated the monitors' focus, distortion, glare, overall image geometry (whether circles appear round or oval, for example), color convergence, and color saturation. They also tested how well the displays were able to handle different video resolutions. All the monitors were tested on identical 33MHz 486 systems using ATI Graphics Ultra Pro video adapters. From the original 29 displays, the 16 with the highest scores in this round of testing went on to the next.

For the subjective jury testing of these monitors, we asked a panel of six jurors to evaluate the monitors for their focus, color quality, contrast and brightness, controls, and ergonomics and design. For this part of the testing, we ran the monitors at 1,024-by-768 resolution.

PC/COMPUTING DECISION MAKER

How to buy the 17-inch display that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Image quality	Color quality	Video signals	NEC MultiSync 5FG
		Construction/ ergonomics	Nonoo FlexScon T560i
	Construction/ ergonomics	Price	Nonoo FlexScon F550i
		Video signals	Nonoo FlexScon T560i
Price	Image quality	Color quality	Zenith ZCM-1790
		Video signals	SuperMotch 17
	Construction/ ergonomics	Video signals	Nonoo FlexScon F550i
		Service and support	Compaq QVision 170
Video signals	Image quality	Construction/ ergonomics	Nonoo FlexScon T560i
		Price	SuperMotch 17
	Price	Construction/ ergonomics	Nonoo FlexScon F550i
		Service and support	NEC MultiSync 5FG

PC Computing BEST

17-INCH DISPLAY

NEC MultiSync claims top spot again.

For the second year running, NEC's MultiSync 5FG wins the No. 1 spot in our 17-inch display category. One look at its bright, crystal-clear display, and you'll see why—it was the only monitor that gained perfect scores for both image and color quality. The 5FG syncs up to resolutions as high as 1,280 by 1,024 at flicker-free 74Hz refresh rates, and its digital front-panel controls allow you to adjust the image to your liking. It also carries a competitive $1,355 street price and is backed by an excellent three-year warranty.

NEC MultiSync 5FG • NEC Technologies • 1255 Michael Dr., Wood Dale, IL 60191 • (800) 388-8888, (708) 860-9500 • $1,599



BEST VIDEO
17-INCH DISPLAYS

Rank	Product	Pros and Cons	Image quality 30%*	Color quality 20%	Price 20%	Video signals 10%	Construction 5%	Documentation 5%	Ease of installation 5%	Service and support 5%	Total Score
1	**NEC MultiSync 5FG** NEC Technologies 1255 Michael Dr. Wood Dale, IL 60191 (800) 388-8888 (708) 860-9500 $1,599	**Pros:** Excellent color and focus; wide range of image controls; competitive price. **Cons:** Pronounced glare from polished tube.	10.0	10.0	8.2	9.4	7.1	10.0	8.5	10.0	**93.6**
2	**Zenith ZCM-1790** Zenith Data Systems 2150 E. Lake Cook Rd. Buffalo Grove, IL 60089 (800) 553-0331 (708) 808-5000 $1,219	**Pros:** Exceptionally low price; good color saturation; solid construction. **Cons:** Lacks some geometry controls.	8.5	9.6	9.9	7.2	8.0	8.5	7.8	9.2	**88.5**
3	**Nanao FlexScan F550i** Nanao USA 23535 Telo Ave. Torrance, CA 90505 (800) 800-5202 (213) 325-5202 $1,499	**Pros:** Sturdy, solid design; extensive image controls; good focus. **Cons:** Colors are muted.	8.8	8.6	8.6	9.0	8.7	9.5	8.5	8.4	**87.4**
4	**SuperMatch 17** SuperMac Technology 485 Potrero Ave. Sunnyvale, CA 94086 (408) 245-2202 $1,399	**Pros:** Crisp, clean, saturated colors; precise focus for type. **Cons:** Awkward side-panel controls.	8.4	8.4	9.1	9.2	7.5	9.5	8.5	9.2	**86.8**
5	**Compaq QVision 170** Compaq Computer 20555 SH 249 Houston, TX 77070 (800) 345-1518 (713) 370-0670 $1,399	**Pros:** Beautiful, rich colors; bright whites and deep blacks; solid build. **Cons:** Lacks some geometry controls (barrelling, pincushioning).	8.6	8.9	9.1	7.4	8.3	9.0	7.8	9.2	**86.4**
6	**Nanao FlexScan T560i** Nanao USA 23535 Telo Ave. Torrance, CA 90505 (800) 800-5202 (213) 325-5202 $2,199	**Pros:** Rich, saturated color quality; excellent focus; impeccable design; thorough selection of image controls. **Cons:** Expensive.	9.7	9.6	5.4	9.6	8.8	9.5	8.5	8.4	**86.3**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Keystone control makes the picture perfect.

The mare image contrals a manitar has, the easier it is ta adjust exactly ta yaur liking—and stave off the image drift and distartian that came as manitars age. **Nanao's FlexScan F550i** includes keystane and pincushianing cantrals—typically faund anly on expensive twa-page displays—ta ensure that the edges af the image are always perfectly parallel. These are cantrals we'd like to see mare manitars affer.



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And The Winner Is...

Best Picture For The 4th Consecutive Year

The results are in. And the Winner is... MAG InnoVision, again. Another much coveted *PC Magazine* Editors' Choice Award goes to a MAG InnoVision monitor (March 1993).

It is the fourth Editors' Choice award for MAG InnoVision monitors in consecutive years. And it's further evidence that MAG InnoVision is designing and manufacturing the very finest computer monitors available today.

At MAG InnoVision we strive to offer superior quality and higher performance at a lower price. That's Value. And value is what all MAG monitors are about.

From the sleek, advanced technology MX-series to the high-performance, high-value LX-series, MAG InnoVision monitors offer the quality and excellence today's savvy computer users demand... and savvy awards committees reward.

Best Monitor In A Supporting Role

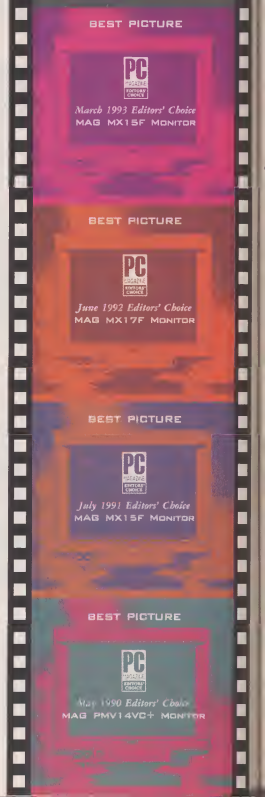
MAG InnoVision monitors also played compelling supporting roles to seven recent award-winning systems.

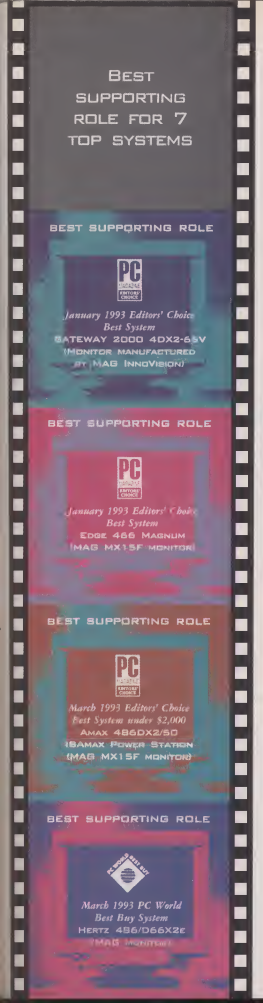
Strong performance/price ratios make MAG monitors the ideal choice for system manufacturers and integrators.

These award-winners count on MAG InnoVision to provide monitors that can match the advanced technology, superior performance and value of their total systems... MAG delivers.

Monitors shown here are artistic presentations of the MAG MX15F model, which may or may not be the model used with the systems.

Best Picture, 4th Consecutive Year







And MAG InnoVision is proud to be a supporting player in these exceptional computer systems.

MAG's own award-winning monitors are available with these award-winning systems as well as for your own system. Ask your computer reseller for a "Screen Test" on a MAG InnoVision monitor.

Or for more information about MAG InnoVision monitors call: 1-800-827-3998, extension 6506

MAG INNOVISION, INC.
4392 CORPORATE CENTER DRIVE
LOS ALAMITOS, CA 90720
714/827-3998 FAX:714/827-552

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20- AND 21-INCH DISPLAYS

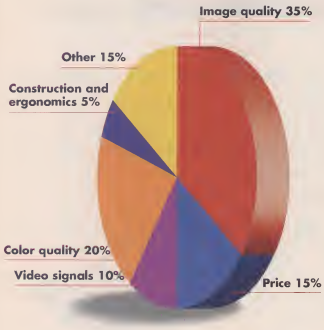
A two-page view for full-time Windows use

Spacious 20- and 21-inch displays aren't just a luxury—for desktop publishing and graphics applications, they can be as essential to getting the job done as the software you're running. Equipped for high resolutions, they're ideal for displaying two pages of text and large image files onscreen without causing eyestrain. Prices have tumbled, and the advantages of running Windows at high resolutions have made them increasingly popular.

For the *PC/Computing* 200, we tested only displays that use use flat-square or Trinitron-style tubes and that have a dot pitch of 0.31mm or smaller (the finer the dot pitch, the sharper the image). We also required that they include digital controls for fine-tuning the image.

DECIDING FACTORS

Image and color quality—what you see onscreen—are the determining factors for a two-page display.



Large displays make higher resolutions possible, which is why we required that all the monitors support resolutions of up to 1,024-by-768 pixels at flicker-free 70Hz (or higher) refresh rates. All but one of the top scorers also support 1,280 by 1024 at high refresh rates. Seventeen monitors met our initial criteria, and seven of those went on to qualify for the winners' list.

Factors and Weights

Image quality is critical in a large-screen display, so it accounts for 35 percent of a monitor's score. Scores for this factor reflect a monitor's focus, brightness, and contrast, and the quality of fine lines and text at small point sizes. **Color quality,** which contributes 20 percent of the total, takes into consideration both the test scores and a jury's evaluation of a monitor's color quality. **Price** accounts for 15 percent of a product's overall score.

The score for **video signals** (10 percent) indicates how well a monitor handles the different video modes, the number of video image settings it stores in memory, its vertical and horizontal refresh rates, and its bandwidth. **Construction and ergonomics** (5 percent) covers the monitor's controls, its active display area, any problems with glare, overall construction quality, and whether the display conforms to the Swedish MPR-2 low-emissions standard. **Service and support** scores (5 percent) reflect the quality of the monitor's warranty and whether it covers both parts and labor. Also contributing 5 percent each are **documentation** and ease **of installation.**

How We Tested

ZD Labs put all the monitors through a series of image and resolution tests. Using a suite of test images and text documents, technicians evaluated the monitors' focus, distortion, glare, image geometry (whether circles appear round or oval, for example), and color saturation. They also tested how the displays handled various video resolutions. All the monitors were tested on identical 33MHz 486 systems using ATI Graphics Ultra Pro video adapters. Of the original 17, 13 had scores high enough to qualify for second-round testing.

Image quality in a monitor is highly subjective. To balance this in our testing, we asked a panel of six jurors to evaluate focus, color quality, contrast and brightness, controls, and ergonomics and design in a side-by-side test. For this evaluation we ran the monitors at 1,024-by-768 resolution using a 16-bit (65,536 colors) driver.

The New Generation 17" Monitor



Advancing into the future is the powerful, new generation ViewSonic 17 . . . with crispness and clarity unheard of before now. So, if a high-contrast, extremely bright, sharply focused screen is important to you, this is the answer! Plus, this remarkable monitor runs at 76Hz refresh at an astonishingly high 1,280 x 1,024 and beyond, which will give you a flicker-free image.

Our unique ViewMatch™ color control is an easy-to-use system that takes the guess work out of printing by adjusting colors to closely match printer output. Brighten the red. Lighten the blue. No problem; it works. And the ViewSonic 17 even has an ergonomically designed drop-down control panel that's as simple to use as a typewriter. More great features include digital controls and advanced anti-reflection coating . . . all adding up to make this everything a 17" monitor should be. With its big screen display and edge-to-edge image, this is the monitor of choice for Windows, desktop publishing and CAD/CAM applications.

For safety and vision protection, the monitor meets strict MPR-II and ISO 9241-3 standards.

Call **800-888-8583** for more information on our products, including our new line of 15" through 21" monitors.

Welcome to the New Generation.

ViewSonic®

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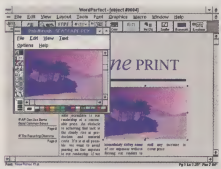
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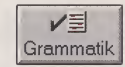
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Now, one year and 2.1 million copies later, there's a new release.

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It's also easier to use, with a souped up spellchecker, Grammatik™ 5 (the industry's best-selling grammar tool), Adobe Type Manager™ and 12 new fonts.

And it includes innovations you'll find nowhere else: QuickFinder, a versatile indexing and text retrieval system, and QuickMenu, a one-click shortcut to customized Button Bars.*

But we haven't changed what's made WordPerfect the sales leader. Release 5.2 is still compatible with WordPerfect 5.1 for DOS and Windows. And it's still backed by the best toll-free support in the business. Call (800) 526-5163 to order a free demo disk.



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PC/COMPUTING DECISION MAKER

How to buy the 20- or 21-inch display that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Image quality	Color quality	Construction/ ergonomics	Nanao FlexScan T660i
		Video signals	NEC MultiSync 6FG
	Construction/ ergonomics	Price	Sony GDM-2038
		Video signals	Nanao FlexScan T660i
Price	Image quality	Color quality	RasterOps 20T MultiScan
		Video signals	NEC MultiSync 6FG
	Construction/ ergonomics	Color quality	Radius IntelliColor/20
		Image quality	Sony GDM-2038
Video signals	Image quality	Color quality	Nanao FlexScan T660i
		Price	NEC MultiSync 6FG
	Price	Color quality	NEC MultiSync 6FG
		Construction/ ergonomics	Radius IntelliColor/20

PC Computing BEST

20- OR 21-INCH DISPLAY

Big is beautiful with NEC's MultiSync 6FG.

Dazzling, bright, handsome . . . those are just a few of the adjectives we heard during the jury testing of NEC's MultiSync 6FG. Like NEC's 15-inch and 17-inch monitors, its 21-inch display was the overwhelming favorite in its class. Affordable at a street price of $2,455, the 6FG supports resolutions from standard 640 by 480 (VGA) up to the ultrahigh resolution of 1,280 by 1,024 pixels at flicker-free 74Hz refresh rates. Backed by a generous three-year warranty on all monitor components, the MultiSync 6FG is irresistible.

NEC MultiSync 6FG • NEC Technologies • 1255 Michael Dr., Wood Dale, IL 60191 • (800) 388-8888, (708) 860-9500 • $2,899



BEST VIDEO
20- AND 21-INCH DISPLAYS

Rank	Product	Pros and Cons	Image quality* 35%	Color quality 20%	Price 15%	Video signals 10%	Construction 5%	Documentation 5%	Ease of installation 5%	Service and support 5%	Total Score
1 BEST	**NEC MultiSync 6FG** NEC Technologies 1255 Michael Dr. Wood Dale, IL 60191 (800) 388-8888 (708) 860-9500 $2,899	**Pros:** Bright, saturated colors; 21-inch tube; great price; exceptional three-year warranty. **Cons:** None.	9.3	10.0	9.1	9.3	6.6	10.0	9.3	10.0	**93.5**
2	**Nanao FlexScan T660i** Nanao USA 23535 Telo Ave. Torrance, CA 90505 (800) 800-5202 (213) 325-5202 $3,999	**Pros:** First-class image quality; solid construction; excellent controls. **Cons:** Expensive.	9.8	9.8	6.5	9.3	8.6	8.9	8.5	8.7	**90.3**
3	**20T MultiScan** RasterOps 2500 Walsh Ave. Santa Clara, CA 95051 (800) 729-2666 (408) 562-4200 $2,499	**Pros:** Excellent price; sharp, well-focused image. **Cons:** 1,280-by-1,024 resolution only at 60Hz refresh.	9.3	8.7	10.0	8.6	7.8	7.8	8.5	8.7	**90.0**
4	**Radius IntelliColor/20** Radius 1710 Fortune Dr. San Jose, CA 95131 (800) 227-2795 (408) 434-1010 $3,199	**Pros:** Rich, even colors; attractive design; no glare. **Cons:** No RGB color or tropezoid controls.	8.5	9.8	8.4	9.7	8.7	9.4	8.5	8.0	**89.0**
5	**Nanao FlexScan F750i** Nanao USA 23535 Telo Ave. Torrance, CA 90505 (800) 800-5202 (213) 325-5202 $3,299	**Pros:** Rich blacks and saturated colors; 21-inch tube; excellent controls. **Cons:** Focus not as sharp as some.	8.6	10.0	8.1	9.0	8.5	8.9	8.5	8.7	**88.6**
6	**Sony GDM-2038** Sony Computer Peripherals 655 River Oaks Pkwy. San Jose, CA 95134 (800) 352-7669 (408) 434-6644 $3,299	**Pros:** Nice design; sharp contrast and focus, particularly on type; crisp, clean whites. **Cons:** Mixed jury results on focus.	8.9	9.7	8.1	9.1	8.9	8.3	8.5	7.3	**88.3**
7	**Philips FastRefresh/20** Philips Consumer Electronics 1 Philips Dr., P.O. Box 14810 Knoxville, TN 37914 (800) 835-3506 (615) 521-4316 $2,495	**Pros:** Great price coupled with nice image quality. **Cons:** Controls difficult to operate; focus not as sharp as others.	8.7	8.9	10.0	7.9	7.9	8.9	7.8	9.3	**88.1**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Styling shades for glare.

The polished gloss tube in **NEC's MultiSync 6FG** makes for beautful images, but under certain lighting conditions it can also mean glare. So NEC designed on antiglare lens that complements the sharp design of its monitors. Unlike most filters, which stick awkwardly onto the front of the display, NEC's lens slides inconspicously and securely onto the face. We just wish the lens were free with all NEC monitors—with models other than the top-of-the-line 6FG, it costs $69 to $170.





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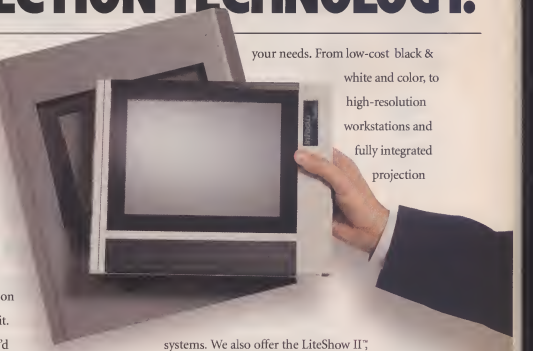
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386SXL/25 386SL/25 Best Buy, April 1993

486DX/33 Best Buy, Laptop Issue, Sept. 1992

NOTEBOOK	CPU	HD (MB)	PRICE
386SXL/25	386SXL-25 MHz. DPTIDNAL 80387SX	80	$1,399 $52/mo*
386SL/25	INTEL 80386SL-25 MHz. 64K CPU CACHE. ADVANCED SL PDWER MGM'T	80	$1,499 $56/mo*
486SX/33	INTEL 80486SX-33 MHz. 8K CPU CACHE	80	$1,999 $74/mo*
486DX/33	INTEL 80486DX-33 MHz. 8K CPU CACHE	130	$2,299 $85/mo*

"With a Graphics Winmark score of 2.3 million, the Compudyne 486DX/33 gives you desktop performance and storage in 7.6 pounds of travel weight." (8/92)

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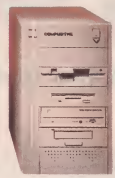
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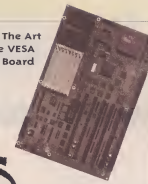
Magazine quotes courtesy of PC Computing, December 1992 pg. 78. ©1992 ZiffCommunications Company. PC Sources, reprinted from PC SOURCES, August 1992. ©1992 Coastal Associates Publishing L.P. PC Bus is optional at an additional cost. √ Must be returned "as new" in original package. *Leasing arranged through Leasing Group, Inc. payments based on 36 month open-end rate. Prices and specs.Kosher CompUSA SuperStore.

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DESKTOP	CPU	RAM/HD	VIDEO BOARD/MONITOR	PRICE	
486SX/25"	INTEL 80486SX-25 MHz, 8K CPU CACHE	4 MB/ 120 MB HD	16-BIT VGA CARD/ 14" 800 x 600 VGA COLOR MONITOR	$999 $37/mo*	PC WORLD BEST BUY
486SX/33"	INTEL 80486SX-33 MHz, 8K CPU CACHE	4 MB/ 170 MB HD	16-BIT SVGA CARD/ 14' 1024x768 SVGA COLOR MONITOR	$1,199 $44/mo*	*486SX/25 Best Buy, Dec. 1992*
486DX/33 CACHE	INTEL 80486DX-33 MHz, 128K CPU CACHE	4 MB/ 210 MB HD		$1,599 $59/mo*	
486DX2/50 CACHE	INTEL 80486DX2-50 MHz, 128K CPU CACHE	4 MB/ 210 MB HD	16-BIT TRUE COLOR SVGA 1 MB VIDEO CARD / 14"1024x768 SVGA .28 DOT PITCH NON-INTERLACED COLOR MONITOR	$1,799 $67/mo*	CBG & H BEST BUY
486DX2/66 CACHE	INTEL 80486DX2-66 MHz, 128K CPU CACHE,	4 MB/ 245 MB HD		$1,999 $74/mo*	*486DX2/66 Nov. 1992*
486DX/50 CACHE	INTEL 80486DX-50 MHz, 128K CPU CACHE	8 MB/ 330 MB HD		$2,299 $85/mo*	

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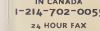
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Circle 195 on reader service card.

Safe and Speedy

IDE hard drives, CD-ROMs, and tape drives access data

Security. That's what you want when you entrust months, even years, of your hard work to a delicate spinning platter of rust-covered metal or a roll of tape. The thought of losing that data can keep you from getting a good night's sleep.

But the fact is, storage devices have reached a new level. Over the past few years, industry standards have evolved and been established for formats and interfaces of IDE hard disks, SCSI CD-ROM drives, and QIC-standard single-user tape backup devices. Mechanical reliability has also improved immeasurably. Dollar for dollar, these devices offer greater data protection than any other technology available today.

That said, a key buying issue is performance. At this point, IDE drives are speed demons. They almost universally boast access times of less than 20 milliseconds and transfer rates of 1.2MB to 1.5MB per second. Since your hard drive is central to any work you do on the PC, you'll want the fastest model you can put your hands on.

CD-ROM and tape drives are another story. The torpid speed of CD-ROM technology will have you itching for the fastest drive you can afford. Tape drives have made speed gains recently, but they're still sluggish compared with hard drives. You can spend a modest few hundred dollars for a solid performer in either category, or drop upward of $1,000 for a unit at the high end of the performance curve.

Essential Storage: 200MB Hard Drives

As upgrades go, a new hard drive is second only to more memory on most users' PC wish lists. With word processors now gobbling 15MB or more of hard drive capacity, graphics files easily exceeding 2MB each, and increasing use of storage-hungry audio and video files, a 200MB second drive is a reasonable starting place for upgrades. Anything less, and you'll be slamming the door on your future needs.

Price wars have resulted in some particularly good bargains (see "Price Per Megabyte Plummets," left). Expect to pay about $400 for a 200MB drive, or around $2 per megabyte. Calculating the price per megabyte helps with comparison shopping not only between various makes of drives, but also in deciding whether the incremental costs of buying a larger or faster hard drive make sense. Accordingly, our Superguide provides a rating for each hard drive based on its price per megabyte.

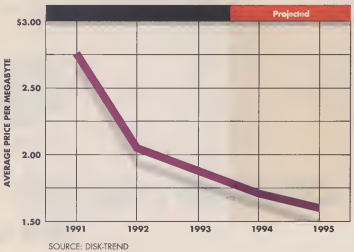
The performance of IDE drives has won IDE technology near universal acceptance in PC system design. Improvements in buffering schemes, the rise of servo voice coils over stepper motors, and some crafty aerodynamic improvements with spinning platters have resulted in faster access times and transfer rates—and virtually killed off the ESDI interface. May it rest in peace.

Drive performance is steeped in gobbledygook, and most of the details matter only for dedicated systems such as network servers and graphics workstations. For general-

PRICE PER MEGABYTE PLUMMETS

Higher demand for hard drives means lower prices.

Projections show that the average per-megabyte cost of 100MB to 200MB IDE and SCSI hard drives will continue to fall.



SOURCE: DISK-TREND

Storage

by the megabyte

INSIDE...

- 200MB Hard Drives 266
- Single-User Tape Drives 270
- CD-ROM Drives 276

purpose business machines, average access time (the time it takes the drive's read/write head to locate and retrieve data from the disk) and data transfer rate (the speed at which a hard drive can deliver data from the disk's surface to the CPU) are the two best barometers of overall performance. Some manufacturers report a drive's average seek time instead of access time, though these numbers mean different things. Seek time is only one component of access times; don't confuse them. In any case, look for an access time of 18ms or less and a transfer rate of 1.2MB per second or faster.

If you need very high performance—especially on a

THE RIGHT DRIVE FOR THE JOB

SCSI drives offer more flexibility, but IDE drives are fast, simple, and cheap.

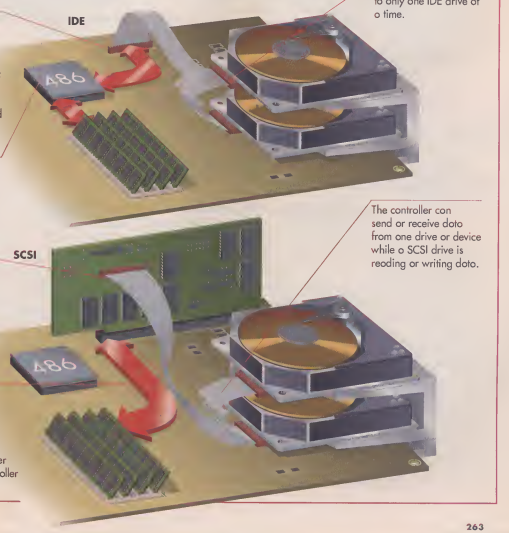


ILLUSTRATION BY TIMOTHY EDWARD DOWNS

true multithreading operating system—or more than 300MB of storage capacity, consider buying a SCSI drive (see "The Right Drive for the Job," page 263). The price per megabyte for SCSI is typically higher than for IDE, especially when you consider that you have to buy a separate controller costing $150 to $250 for the drive.

But if you need football fields of storage, remember that another key advantage of SCSI is that you can daisy-chain up to seven devices. IDE drives are limited to two drives in a master/slave capacity—another good reason to buy at least 200MB of capacity in a second drive.

Served on a Silver Platter: CD-ROM Drives

CD-ROM has finally matured. The ability to pack 630MB or more of data onto a single disc has always appealed to users, but high price, the lack of industry standards, and the slender selection of titles held the technology back.

No more: Prices on CD-ROM drives have plummeted. Drives are now widely available for under $1,000, and some cost as little as $200. Meanwhile, the High Sierra data format has become an industry standard. And while some CD-ROM drives still use proprietary interfaces, the industry has moved overwhelmingly to SCSI, which guarantees wide compatibility with existing PCs and relatively high performance. Moreover, the number of commercial titles has more than quadrupled in five years, spurred partly by multimedia.

Performance has remained CD-ROM's chief drawback, though access times are approaching 250ms or faster. Speedier drives are more expensive, as you'll quickly discern by pricing variable speed drives, which typically cost around $1,500 (see "Variable-Speed CD-ROM is Performance Champ," facing page). You'll want a drive that's as fast as your budget allows. For searching through a CD-ROM database, access times slower than 500ms will have you finger-drumming grooves into your desk. If you need a drive that handles animation, say for business presentations, faster performance is essential.

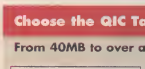
Fortunately, transfer rates have improved as well. Look for a drive with a transfer rate of 150KB or higher, the MPC specification, which all six of our CD-ROM drive winners had. This transfer rate will let your drive run the vast library of MPC CD titles now coming to market—which includes a growing number of business titles. Also, better drives come with at least a 32K buffer (again, true of all our winners); a 64K cache improves speed even more. And in the dawn of the multimedia age, a good CD-ROM drive should come with an audio jack. After all, business presentations that don't support sound and animation will soon go the way of the dinosaurs.

Backup of One's Own: Single-User Drives

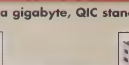
The snarl of competing standards in single-user tape backup drives has finally been resolved in favor of the

Choose the QIC Tape Drive that Suits Your Needs

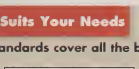
From 40MB to over a gigabyte, QIC standards cover all the bases.



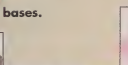
QIC-40 Standard
Capacity: 40MB to 120MB.
Specifications: DC2000-compatible; $200 to $300; 2MB to 3MB per minute; floppy controller.
Pros: Inexpensive.
Cons: Limited capacity; slow transfer rate.



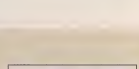
QIC-80 Standard
Capacity: 120MB to 250MB (compressed).
Specifications: DC2120-compatible; $250 to $600; 2.5MB to 4MB per minute; floppy controller or parallel port.
Pros: Inexpensive; third-party software is readily available.
Cons: Limited capacity; slow transfer rate.



QIC-525 Standard
Capacity: 500MB to 1000MB.
Specifications: Full-size QIC cartridge (DC6525-compatible); $600 to $1,200; 7MB to 12MB per minute; SCSI controller.
Pros: High capacity; fast transfer rate.
Cons: High price.



QIC-500 Standard
Capacity: 500MB to 1,000MB.
Specifications: QIC-143 minicartridge; expected price $500 to $1,000; 8MB to 18MB per minute; floppy controller or parallel port.
Pros: Faster transfer rate; high capacity; uses QIC minicartridge; less expensive than similar-capacity drives.
Cons: Not available until later this year.



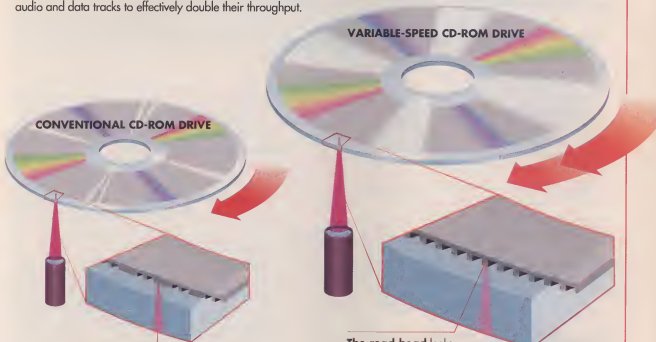
QIC-555 Standard (proposed)
Capacity: 555MB to 1100MB.
Specifications: QIC-143 minicartridge; expected price $550 to $1,000; 8MB to 18MB per minute; SCSI controller.
Pros: Faster transfer rate; high capacity; uses QIC minicartridge, less expensive than similar-capacity drives.
Cons: Not available until later this year.

PHOTOGRAPHS BY ERNIE PRZEKURAT

VARIABLE-SPEED CD-ROM IS PERFORMANCE CHAMP

High-priced drives move data faster than conventional designs.

Priced at around $1,500, variable-speed CD-ROMs can distinguish between audio and data tracks to effectively double their throughput.



The laser beam in the drive's read head detects a series of raised and depressed areas (called lands and pits) that store binary data on the surface of the CD. The data can be either saund ar ather data (such as graphics and text); canventianal CD-ROM drives cannat detect distinctians between types of data.

The read head looks for a pattern of binary code (stared in the lands and pits) that is unique to audia recardings. If this pattern is detected, the drive spins the disk at its standard speed for audia playback. If the code is nat faund, the drive assumes that the disk cantains graphics ar text rather than audia data and daubles the speed at which the disk is spun.

ILLUSTRATION BY TIMOTHY EDWARD ODONNELL

quarter-inch cartridge (QIC) standard in various capacities. QIC devices are cheap, reliable, and widely interoperable with other backup devices, which is keenly important for any archiving medium. If you're purchasing a tape drive for a network, however, you may also want to evaluate digital audio tape (DAT) devices. (See our coverage of LAN tape drives in "The Well-Connected Office," page 158.)

Backup speed is another critical issue, and our tests revealed considerable variation among products. The 14 single-user tape drives we tested required anywhere from 7 to 47 minutes to back up 60MB of data. The average drive took about 21 minutes.

SCSI is the fastest tape drive interface. Drives that connect through the parallel port tend to be slower, and drives that connect through the floppy drive controller are slower still. Our highest-ranked tape drive is an internal device that uses a floppy controller but is far less costly than the number two product, an external drive with a parallel port interface. Some vendors now offer fast caching bi-directional parallel ports or floppy IDE controller accelerators that boost the throughput of QIC-80 drives for as little as $150.

In recent years, prices of tape backup drives for general business use have fallen precipitously. You can buy a QIC-80 drive for $250 to $350. Expect to pay around $1,000 for units that back up 300MB of data or more at transfer rates of at least 10MB per minute (see "Choose the QIC Tape Drive that Suits Your Needs," facing page).

A drive's backup software should accommodate your specific work habits. Better packages back up individual files rather than making "image" backups, which makes it easier to locate and restore individual files later. Several splendid third-party backup packages, such as Norton Backup, the backup utility in PC Tools, and Back-It, work with the more popular drives. If you find an otherwise excellent drive that comes with a shoddy back-up program, scratch the software for a third-party package. Good back-up packages should save you time and help you avoid hassles—otherwise, what's the point?

200MB HARD DRIVES

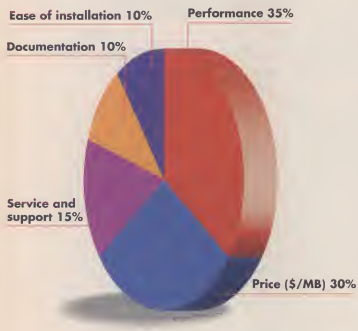
The universal upgrade—especially for Windows PCs

Your system isn't exactly new, but it's still good enough to keep around for a while. The problem is the hard drive it came with, which is beginning to show signs of age. Worse yet, at under 100MB it no longer has enough free space for all those Windows applications and megabyte-gobbling data files. What to do?

Our research shows that a hard drive upgrade to a capacity of around 200MB is the most-sought solution in these circumstances. Since most computers today use an IDE drive interface, we've focused on the simplest and least expensive hard drive upgrade, looking at IDE drives with capacities ranging from 180MB to 250MB and list prices under $750. The drives we tested for the *PC/Computing* 200 all conformed to a 5¼-inch, half-height or smaller form factor. We started out with 14 drives; 6 made our winners list.

DECIDING FACTORS

Performance is the first priority in choosing a hard drive; price per megabyte follows closely behind.



Factors and Weights

Performance and price have become the criteria for judging the standard of quality among peripherals and systems. Scores for **performance** (contributing 35 percent of each product's overall score) reflect the results of tests for disk throughput and disk access. Scores for **price** (30 percent) reflect each unit's cost per megabyte based on list prices and specified capacity.

Service and support (15 percent) takes into account not only product warranties but also the different methods available to users for obtaining troubleshooting information—toll-free support, BBS's, and so on. And since the objective of this type of upgrade is to accomplish it with as little expense and equipment manipulation as possible, disks receive high scores for **ease of installation** (10 percent) when port and cable placement is logical and well designed, when proper mounting accessories are included, and when factory defaults without modification are sufficient to get up and running quickly. Scores for **documentation** (10 percent) reflect the usefulness of the printed materials included with the drive and the quality of the installation software's online help. Good manuals were well written and illustrated, and provided troubleshooting and error-handling sections.

How We Tested

We individually unpacked each drive and inventoried the package contents. We took special note of device dimensions, construction quality, overall design, and installation accessories (rails, screws, cables, and installation or enhancement software). Next, we installed each drive into a standard 5¼-inch drive bay in a low-profile/small-footprint desktop system with IDE circuitry on the motherboard. We considered any special help pamphlets or software. (The information they offered was aimed at enhancing the installation procedure, especially the placement of jumpers, sockets, pins, or switches that might need adjustment.) We loaded test files onto each drive from an external Bernoulli Transportable 90, which was then removed from the test computer. Performance scores are based on the Disk Harmonic segment of ZD Bench 2.01 and the time value generated by WinTest, ZD Labs' application-based benchmark suite.

PC/COMPUTING DECISION MAKER

How to buy the 200MB hard drive that's best for your business.

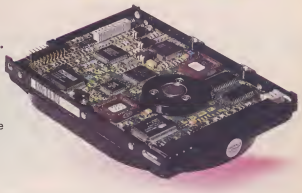
1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Performance	Price	Documentation	Seagate ST3283A
		Ease of installation	Seagate ST3283A
	Service and support	Documentation	Canner Filepro 250 CP30254
		Ease of installation	Canner Filepro 250 CP30254
Price	Performance	Documentation	Seagate ST3283A
		Ease of installation	Canner Filepro 250 CP30254
	Service and support	Documentation	Seagate ST3283A
		Ease of installation	Maxtar 7245
Service and support	Price	Documentation	Quantum PraDrive LPS240
		Ease of installation	Maxtor 7245
	Performance	Documentation	Quantum PraDrive LPS240
		Ease of installation	Canner Filepro 250 CP30254

PC Computing BEST

200MB HARD DRIVE

Conner Filepro 250 CP30254 captures top honors.

With on occess time of 14 milliseconds, the Filepro 250 CP30254 offers greot performonce. And for under $2 per megobyte, this 251MB drive is o greot volue in onybody's book. Besides price and performance, o good hord disk drive offers reliobility. Conner hos such confidence in the Filepro 250 CP30254 thot it's included in the company's new two-yeor worronty plon. Price, performonce, service ond support, eose of instollotion—whot more could you osk? The Conner Filepro 250 CP30254 hos it oll.



Conner Filepro 250 CP30254 • Conner Peripherals • 3081 Zonker Rd., San Jose, CA 95134-2128 • (800) 426-6637, (408) 456-4500 • $490

Rank	Product	Pros and Cons	Performance * 35%	Price ($/MB) 30%	Service and support 15%	Documentation 10%	Ease of installation 10%	Total Score
1	**Conner Filepro 250 CP30254** Conner Peripherals 3081 Zanker Rd. San Jose, CA 95134-2128 (800) 426-6637 (408) 456-4500 $490	**Pros:** Best price per MB; excellent performance. **Cons:** Noticeable noise level; documentation lacking.	9.8	10.0	9.3	7.5	8.7	**94.5**
2	**Seagate ST3283A** Seagate Technology 920 Disc Dr. Scotts Valley, CA 95066 (408) 438-6550 $655	**Pros:** Best performance; excellent price per MB; short, concise documentation. **Cons:** Lauder operation than most.	10.0	9.7	8.0	8.4	8.7	**93.2**
3	**Quantum ProDrive LPS240** Quantum Corp. 500 McCarthy Blvd. Milpitas, CA 95035 (800) 624-5545 (408) 894-4000 $469	**Pros:** Very good performance and price per MB; two-year warranty; auto-install disk included. **Cons:** Must use disk to set BIOS.	9.6	9.7	9.5	7.5	8.0	**92.5**
4	**Western Digital Covior AC2200** Western Digital Corp. 8105 Irvine Center Dr. Irvine, CA 92718 (714) 932-4900 $649	**Pros:** Good performance, service and support, and ease of installation. **Cons:** Pricey.	9.3	8.1	8.1	8.9	8.7	**86.6**
5	**Maxtor 7245** Maxtor Corp. 211 River Oaks Pkwy. San Jose, CA 95134 (800) 462-9867 (408) 432-1700 $445	**Pros:** One of two easiest installations; excellent price per MB and service and support. **Cons:** Poor documentation.	7.3	9.7	9.6	7.3	10.0	**86.4**
6	**Identity 220MB Internal IDE Hard Drive Kit** Identity Systems Technology 1347 Exchange Dr. Richardson, TX 75081 (800) 723-8258 $649	**Pros:** Excellent performance. **Cons:** Pricey; front panel made it difficult to fit drive in cabinet.	9.7	8.1	8.1	8.9	6.7	**86.0**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE

CLOSE-UP: DESIGN IN DETAIL

Less is more in Quantum's new hard drive series.

Quantum's ProDrive LPS240 strikes a blow far greater hard drive reliability by designing its ProDrive series with 40 percent fewer parts than conventional drive assemblies. ASIC (application-specific integrated circuits) count is down to 11 from 16. Data density per platter is greater and requires one head less. Quantum's higher level EPS series drives also have their motors integrated with their chassis. The result of all this streamlining: reduced field defect rates and failures per million, according to company tests.



Fewer Heads

WinMaster 1.5 proudly offers you less than the competition.

Our new Windows utility package delivers nothing but speed, control, and productivity. Period.

Less time accessing data and programs.

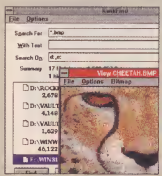
No one takes the waiting out of Windows™ like new WinMaster™ 1.5. Our Toolbox offers fast, easy access to applications and files, and it can automatically load and launch them when you boot up Windows. Customizable by size, shape, and screen location, WinMaster's Toolbox lets you access your programs by a single mouse click. And it can float on top, or pop to the surface with a mouse click or hot key.



Toolbox application launcher uses minimal screen space and can be configured to suit your preferences.

Less time looking for files.

WinMaster's KwikFind™ helps you track down mislaid files in seconds, by file name, type, or content. You can search single or multiple drives and networks, too. And, since KwikFind runs in the background, you're free to continue working while it hunts. That's a *real* time-saver.



*With **KwikFind**, you don't need to know the name of a missing file to find it.*

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Less to worry about.

WinMaster gives you dynamic performance monitoring and analysis. Plus the tools to keep Windows running smoothly. KwikVault,™ for easy drag-and-drop file compression, gives you more disk space. And Power Disk® delivers a faster hard disk (you can even schedule it to run automatically!).



KwikInfo™ allows you to monitor disk performance with floating meters and interactive reports.

At $69.95, even the price is less!

Order WinMaster 1.5 today and save $60.00 off suggested retail. You'll also get Super PC-Kwik, our award-winning disk cache, at no extra cost. With our 90-day money-back guarantee and outstanding technical support, this is one time when less is more.



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SINGLE-USER TAPE DRIVES

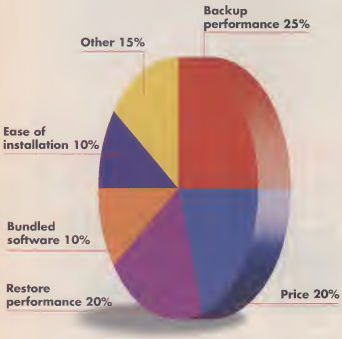
Your insurance against hard disk disaster

Hard disk failure ranks right up there behind death and taxes as one of life's inevitables. If you lose your application software, you can probably reconstruct it fairly easily. But losing precious data files could devastate your business. Tape backup devices are your best insurance against disk disaster.

We tested 20 tape drives by major manufacturers and then winnowed the list to the 10 best. These drives are intended for single-user workstations. They have capacities of at least 250MB and list prices under $700. (The prices shown in the chart reflect the cost of the drive, the software, and one tape, so in some cases they vary from the list price when those extras don't come standard with the drive.) All of these drives use easy-to-store QIC minicartridge tapes. Some drives operate from the parallel port or via a SCSI card on the system's ISA bus, but the majority use the PC's floppy drive interface. We evaluated both internal and external drives; when a drive came in both versions, we used the external drive.

DECIDING FACTORS

Backup and restore performance are the key criteria, but the best tape drives also have a low price.



Factors and Weights

The most reliable tape backup drive in the world is good only if you use it. And the more time-consuming your backup chores, the more likely you are to forgo them. For this reason, we rate **backup performance** as the most important consideration (25 percent of the total score). We tested the speed and accuracy of backup, tape-verification, data-compression, data-comparison, and unattended-backup operations. And since a backup is only as good as the data it restores to your disk, accurate **restore performance** (20 percent) is the other half of the performance equation. We tested both the time it took to restore data and the accuracy of the data itself.

Price, always an important consideration, accounts for 20 percent of the score. The quality of the **bundled software** and the **ease of installation** are each rated at 10 percent. The quality of software bundled with the drives tended to vary widely. Good **documentation** and **service and support** help ease the learning curve, so we weighted each factor at 5 percent. The **exception processing** score (5 percent) reflects the software's method of handling bad data, the variety and quality of the error messages, and the variety and quality of error logs generated with each operation.

How We Tested

To test the speed of backup, restore, tape-verification, and data-comparison operations, we used a 60MB data load consisting of different file types; for the data-compression tests, we used a 120MB data load. We also tested standard software features included with these drives, including erase and unattended-backup-and-restore procedures. We tested the accuracy of restored data using special ZD Labs software and created logical disk errors to see how the software handles such data errors as cross-linked files and files with lost sectors; we also judged the quality of the error messages.

If you've ever tried to call a technical-support representative only to be parked indefinitely on hold, you'll be happy to know we also clocked response time.

PC/COMPUTING DECISION MAKER

How to buy the single-user tape drive that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Backup performance	Restore performance	Service and support	Tecmar MiniVault 250
		Bundled software	Optima DisKavery 525T
	Bundled software	Service and support	Tecmar MiniVault 250
		Price	Tecmar MiniVault 250
Price	Backup performance	Bundled software	Talan 250 Tape Backup
		Ease of installation	Talan 250 Tape Backup
	Restore performance	Service and support	Colarada Jumba 250
		Bundled software	Colarada Jumba 250
Restore performance	Exception processing	Bundled software	Optima DisKavery 525T
		Service and support	Tecmar MiniVault 250
	Price	Bundled software	Summit Express SE305
		Service and support	Tecmar MiniVault 250

PC Computing BEST

SINGLE-USER TAPE DRIVE

Jumbo 250 wins top honors.

Hats off to Colorado Memory Systems' Jumbo 250, the best overall tape backup drive. It offers a low price, respectable performance, and easy installation, and it scored solidly in service, support, and documentation. Its backup speed (2.3MB per minute) was not the most impressive, but we liked its overall combination of features. Protect your valuable data with Colorado's Jumbo 250. It's your best insurance.



Jumbo 250 • *Colorado Memory Systems* • 800 S. Taft Ave., Loveland, CO 80537 • (800) 845-7905, (303) 669-6500 • $279

SINGLE-USER TAPE DRIVES

Rank	Product	Pros and Cons	Backup performance 25%*	Price 20%	Restore performance 20%	Bundled software 10%	Ease of installation 10%	Documentation 5%	Exception processing 5%	Service and support 5%	Total Score
1 PC Computing BEST	**Jumbo 250** Colorado Memory Systems 800 S. Taft Ave. Loveland, CO 80537 (800) 845-7905 (303) 669-6500 $279	**Pros:** Easy installation; price; service and support; uses QIC-80 tapes. **Cons:** Below-average data-transfer rate; software available only on 5¼-inch disks.	8.4	9.8	8.3	8.9	10.0	9.6	8.9	9.5	**90.1**
2	**Trokker 250** Colorado Memory Systems 800 S. Taft Ave. Loveland, CO 80537 (800) 845-7905 (303) 669-6500 $548	**Pros:** Excellent software bundle, documentation, and support; very good data-transfer rate. **Cons:** Relatively expensive.	8.6	7.6	8.6	10.0	10.0	10.0	10.0	9.5	**88.7**
3	**FileSafe 8500 IDE** Mountain Network Solutions 240 E. Hacienda Ave. Campbell, CA 95008-6623 (800) 458-0300 (408) 379-4300 $599	**Pros:** Easy installation; excellent documentation; good data-transfer rate. **Cons:** Must set jumper pins on IDE interface; expensive.	9.1	7.2	9.4	8.2	10.0	10.0	8.6	9.0	**88.0**
4	**MiniVault 250** Tecmar 6225 Cochran Rd. Solon, OH 44139-3377 (800) 624-8560 (216) 349-0600 $519	**Pros:** Excellent exception processing and service and support; very good data-transfer rate. **Cons:** Confusing instructions for verifying operation; difficult installation.	9.1	7.9	9.4	9.6	6.4	8.4	10.0	10.0	**87.6**
5	**Tolon 250 Tape Backup** Hard Drives International 1912 W. Fourth St. Tempe, AZ 85282 (800) 927-7848 (602) 350-1176 $249	**Pros:** Low price; superb documentation; easy installation; Back-It software included. **Cons:** Below-average data-restore performance and data-transfer rate; slow tech-support response.	8.4	10.0	6.8	8.9	10.0	9.6	8.9	8.0	**86.8**
6	**DisKovery 525T** Optima Technology 17526 Von Karman Ave. Irvine, CA 92714 (714) 476-0515 $858	**Pros:** Fastest drive we tested; high capacity; NovaBack software included; excellent data-transfer rate. **Cons:** Most expensive drive tested.	9.7	5.2	9.9	9.6	9.1	8.0	9.6	8.5	**86.2**
7	**Summit Express SE250** Summit Memory Systems 100 Technology Circle Scotts Valley, CA 95066 (800) 523-4767 (408) 438-2660 $312	**Pros:** Good price; good data-transfer rate; software detected bad data. **Cons:** Slow tech-support response	8.5	9.5	8.5	8.2	9.1	8.0	7.9	6.1	**85.6**
8	**Summit Express SE305** Summit Memory Systems 100 Technology Circle Scotts Valley, CA 95066 (800) 523-4767 (408) 438-2660 $392	**Pros:** Fast; uses QIC-80 tapes; very good data-transfer rate. **Cons:** Below-average data-restore performance, installation, and bundled software.	9.3	8.9	8.0	7.2	7.3	9.2	8.9	8.5	**84.9**
9	**Backpack Tape Drive** Micro Solutions 132 W. Lincoln Hwy. Dekalb, IL 60115 (815) 756-3411 $539	**Pros:** Portable; rugged case; very good data-transfer rate. **Cons:** No quick-start guide with installation.	8.8	7.7	7.7	9.3	7.3	8.8	8.2	8.5	**82.2**
10	**Tape250 Parallel Port** Iomega 1821 W. Iomega Way Roy, UT 84067 (800) 777-6004 (801) 778-1000 $583	**Pros:** Portable; CP Backup software detected bad data. **Cons:** Below-average data-transfer rate; poor exception processing.	8.2	7.4	8.7	7.9	10.0	7.3	6.1	9.5	**82.1**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE

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PM9600FX
V.32/V.42bis with 9600 S/R FAX
Was $299
Now Just **$229.**
Includes software



PM9600
V.32/V.42bis
Was $379
Now Just **$199.**
Includes software



PM2400EFXSA
V.42bis with 9600 S/R FAX ***Was $199***
Now Just **$169.**
Includes software



PM2400EFX V.42bis with 9600 S/R FAX
Was $189
Now Just **$159.**
Includes software



PM2400SA
Was $139
Now Just **$89.**
Includes software



PM2400
Was $119
Now Just **$79.**
Includes software



PM14400FXMT
V.32bis with 14400 S/R FAX ***Was $429***
Now Just **$299.**
Includes software and cable



PM9600MT
V.32/V.42bis with 9600 S/R FAX
Was $349
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PM2400EFXSA
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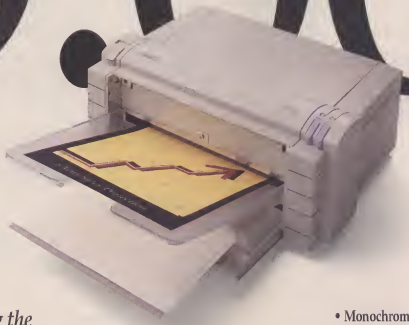
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Circle 110 on reader service card.

Available January 1993

CD-ROM DRIVES

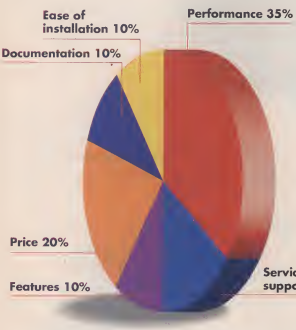
Access a new generation of information

The popularity of emerging multimedia applications, perhaps more than anything else, has focused attention on a relatively new storage medium—CD-ROM drives, which have become the least expensive way to store and distribute the enormous amount of information required by next-generation software. CD-ROM drives are becoming necessary not only for multimedia buffs but also for those who work with comprehensive databases and huge applications like desktop publishing programs. The list goes on, and it will continue to grow as more types of applications take advantage of this cost-effective medium.

To qualify for testing in the *PC/Computing* 200, CD-ROM drives had to mount internally. Most were SCSI units, though a couple used proprietary, non-SCSI interfaces. Of the 14 units we tested, only 6 made the finals.

DECIDING FACTORS

Performance—including data-transfer rate and compatibility—is the main criterion.



Factors and Weights

Performance is paramount in this category, accounting for 35 percent of each product's total score. Scores for this factor depend not only on how quickly data was transferred from the CD-ROM to main memory but also on compatibility with the array of data types usually stored on CD-ROMs. **Price** counts for 20 percent, since the most expensive CD-ROM drive isn't necessarily the best performer. **Service and support** (15 percent) takes into account the variety of avenues users have for getting technical assistance. The better-scoring products generally include toll-free telephone support, a BBS, and at least a one-year warranty.

Kodak PhotoCD support, multisession support, multispeed operation, audio output jacks, a volume control, and the quality of construction are the **features** (10 percent) that score the biggest points. High scores for **ease of installation** (10 percent) reflect well-organized installation software, logical port and cable placement, and default settings that let users get the drive up and running quickly. The final 10 percent of each product's score depends on the quality of its **documentation.**

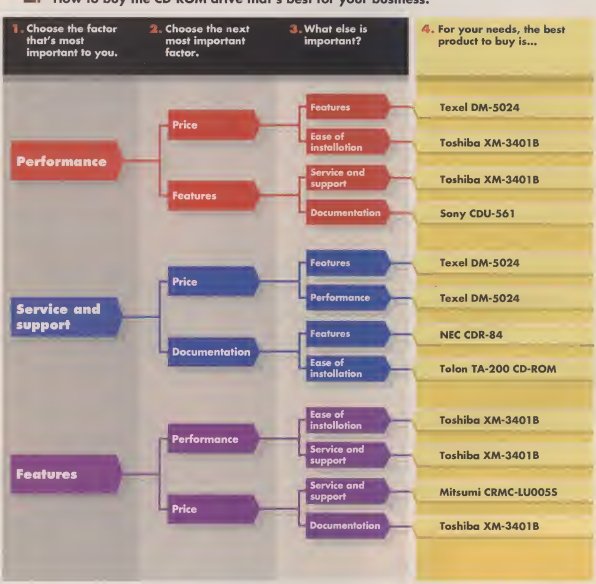
How We Tested

ZD Labs mounted each CD-ROM drive in turn into a test machine, noting ease of hardware installation, device connection, success of software-driver installation, and volume mounting and unmounting. The installation complete, we began intensive disk-access testing, timing a word search in Grolier's Encyclopedia and running through the returned title list. We tested sequential block reads—an important capability for multimedia applications—by timing page turns in *Just Grandma and Me.* And since some of these drives can play ordinary audio CDs, we measured their frequency response, signal-to-noise ratio, and stereo separation.

We also tested each drive's ability to mount and access *sessions* (data written to a disk at different times) on a multisession CD. We tested Kodak PhotoCD compatibility—a de facto industry standard that includes specially formatted data stored in single or multiple sessions—by loading a contact sheet of 24 photos from a single-session PhotoCD using Photoedge. We tested load throughput by timing the opening of a 40MB Photostyler image file.

PC/COMPUTING DECISION MAKER

How to buy the CD-ROM drive that's best for your business.



PC Computing BEST

CD-ROM DRIVE

Toshiba XM-3401B leads the pack.

The top-roted Toshibo XM-3401B scored omong the best in most categories. First in performonce ond service ond support, ond tying for second in product features, this drive hondles ony digital dato you might throw ot it. It hos the second-best frequency response tested, on excellent signol-to-noise rotio, ond good stereo seporotion. It hod no problem mounting and reoding PhotoCDs; multisession, stondord-formot doto CDs; ond multisession PhotoCDs. The Toshibo XM-3401B mokes choosing o CD-ROM drive simple.



Toshiba XM-3401B • Toshiba America Information Systems, Disk Products Division • 9740 Irvine Blvd., Irvine, CA 92718 • (714) 583-3111 • $695

Rank	Product	Pros and Cons	Performance* 35%	Price 20%	Service and support 15%	Documentation 10%	Ease of installation 10%	Features 10%	Total Score
1 BEST	**Toshiba XM-3401B** Toshiba America Information Systems 9740 Irvine Blvd. Irvine, CA 92718 (714) 583-3111 $695	**Pros:** Excellent performance, service and support, and product features; mounts multisession PhotoCDs. **Cons:** High price.	9.7	7.9	10.0	8.1	9.4	9.4	**91.7**
2	**Texel DM-5024** Texel 1605 Wyatt Dr. Santa Clara, CA 95054 (800) 886-3935 (408) 980-1838 $499	**Pros:** Excellent performance, price, and service; easy to install; good documentation. **Cons:** No multisession PhotoCDs; door operation requires both hands.	9.0	9.2	10.0	8.4	8.6	8.8	**90.7**
3	**Talon TA-200 CD-ROM** insight Distribution Network 1912 W. Fourth St. Tempe, AZ, 85281 (800) 927-7848 (602) 902-1176 $549	**Pros:** Excellent service, documentation, performance, and price; good product features. **Cons:** No multisession PhotoCDs; software installation confusing; must have CD in drive to mount at start.	8.5	8.9	10.0	9.2	8.9	8.8	**89.5**
4	**NEC CDR-84** NEC Technologies 1255 Michael Dr. Wood Dale, IL 60191 (800) 366-0476 (708) 860-9500 $649	**Pros:** Best documentaton; excellent service and support; innovative daar mechanism. **Cons:** Doesn't read multisession PhotoCDs.	8.6	8.2	10.0	10.0	8.6	8.8	**88.9**
5	**Mitsumi CRMC-LU005S** Mitsumi Electronics Corp. 4655 Old Ironsides Dr. Suite 130 Santa Clara, CA 95054 (408) 970-0700 $399	**Pros:** Best price and features; good performance; mounts multisession PhotoCDs. **Cons:** Software/documentation combo makes installation difficult.	8.6	9.9	8.8	7.7	7.5	10.0	**88.3**
6	**Sony CDU-561** Sony Corp. One Sony Dr. Park Ridge, NJ 07656 (800) 352-7669 (201) 930-6432 $699	**Pros:** Excellent performance; very good features; easy installation; good load/eject mechanism and service and support. **Cons:** Highest price in group; SCSI scan at boot is slow.	9.5	7.9	8.2	8.1	8.6	9.4	**87.5**

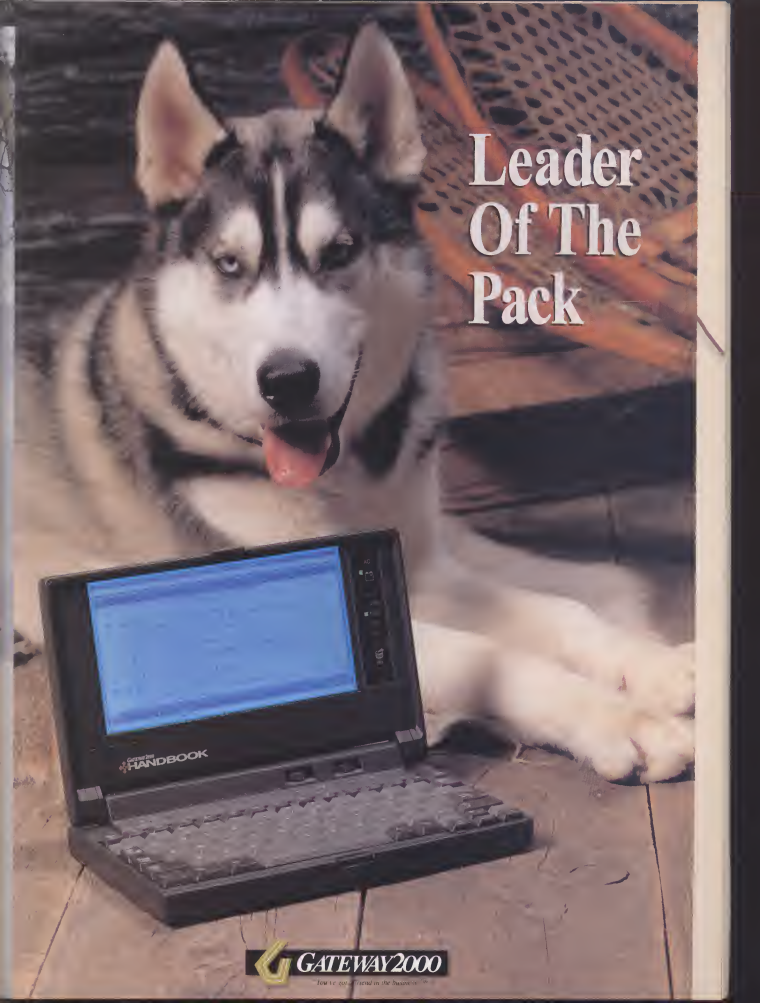
* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

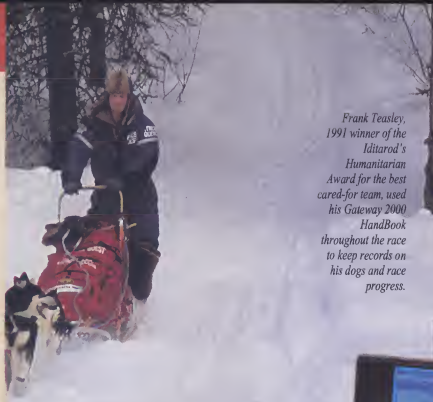
CLOSE-UP: DESIGN IN DETAIL

Double doors deter dust.

The biggest threat to o new CD-ROM drive is everywhere—it's dust. Because CD-ROM drives can't be sealed to keep dust out, NEC's come up with a compromise solution. Instead of the single-door orrongement found in conventionol CD-ROMs (bottom), the **NEC CDR-84** hos o double-door design thot's the next best thing to o hermetic seol (top). And it feotures single-honded operotion, something thot's missing even in some single-door drives.




Leader
Of The
Pack
HANDBOOK
GATEWAY2000



Frank Teasley, 1991 winner of the Iditarod's Humanitarian Award for the best cared-for team, used his Gateway 2000 HandBook throughout the race to keep records on his dogs and race progress.



Regularly priced at $1295, the HandBook is now only $995. Save $300!

Go The Distance!

Frank said the HandBook's exclusive auto-resume feature was a big plus, too. Being able to open the HandBook and start working exactly where he left off made it effortless to use.

Although the dogs slept an average of 12 hours a day during the race, Frank was lucky to sleep 45 minutes daily. He was busy making straw beds, putting ointment on the dogs' feet, replacing their polar fleece booties, preparing their food, repairing harnesses and repacking while the dogs rested. "Sleep deprivation can be hazardous to a musher's ability to focus on details. The HandBook kept me on top of my schedule so I could concentrate on the dogs and they could concentrate on what they love best: the race."

Frank concluded, "There's not another computer small enough or powerful enough to come through for us the way the HandBook did."

It's a PC that's the perfect companion in even the most demanding situations, even if you never leave your office. Get the leader of the pack: Gateway 2000's HandBook!

GATEWAY2000

"You've got a friend in the business."®

800-846-2062



Gateway's HandBook Is The First Portable To

On March 6, 1993, 68 men and women, 1,253 dogs and one portable computer left the starting line in the 21st running of the Iditarod dogsled marathon. Not all of the men, women and dogs made it through nearly 1,100 miles of blinding snow, howling wind, mountainous terrain and sub-zero temperatures – but the PC did!

It was the first time anyone ever took a portable all the way from Anchorage to Nome on a dogsled. Appropriately, the first portable PC to go the distance was the first product in an entirely new category of portables; the unique and innovative product that defined new standards for portable PCs: the HandBook, pioneered by Gateway 2000. At just 2.75 pounds, measuring only 6 x 10 inches yet including a 40MB hard drive, a backlit, use-it-anywhere screen and comfortable keyboard, the HandBook was the only choice for Iditarod musher Frank Teasley.

"I've always wanted a way to carry my racing strategy with me and to record my progress during the race," said Frank. "But I can't afford any extra weight on the dogsled, and you don't find many electrical outlets on the trail. The HandBook easily fit in the dogsled, and I used it at checkpoints to review details of the trail ahead, information on my competition, and notes on my dogs." Because he couldn't recharge batteries on the trail, Frank ran his HandBook on AA batteries kept warm in his parka.

The Perfect Companion!

The Gateway 2000 HandBook®

- Weight: 2.75 lbs. (includes battery)
- Dimensions: 5.9" x 9.75" x 1.4"
- AC adapter/charger measuring
- NiMH 2.3Ah battery; approximately 4.5 hrs. battery life with power management
- Alkaline battery pack; (AA batteries not included)
- C & T processor, 286-class performance
- 1MB RAM, upgradeable to 3MB
- 40MB hard drive
- Backlit 7.6" double-scan 640 x 400 resolution screen
- 1 parallel and 1 serial port
- 78-key keyboard; 101-key emulation, inverted-T cursor pad
- Microsoft® MS-DOS® 5.0, Interlink and your choice of WordPerfect® for DOS 5.1 or Microsoft Works™ for DOS 2.0
- Serial download cable

$995



1993 BYTE — Editor's Choice — Top Notebook

1993 BYTE — Editor's Choice — Second Notebook

Popular Science

Computer Shopper MVP Award

HandBook Options

- 2400bps data/9600bps send-and-receive fax/modem with software, $165
- Citizen PN48 portable printer, $380
- Extra AC adapter, $75
- Extra 2.3Ah batteries (each), $70
- RAM upgrade to 3MB, $130
- Combo unit (1.44MB 3.5" external floppy drive with 1 parallel and 1 serial port), $265
- Extended VIP warranty (24-hour factory service turnaround), $100 (must be purchased at the time of sale)



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Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CT)

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SOUND.

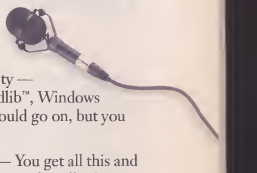


People are talking about PC sound cards. And Pro AudioSpectrum™ 16 is the one they're talking about. It's the top-selling 16-bit PC sound card, for a lot of good reasons:

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- SCSI — Compatible with more industry standard CD-ROM drives than any other card.
- Stereo Music Synthesizer — Built with the industry standard Yamaha stereo synthesizer with 20 voices.



- 100% Compatibility — Sound Blaster™, Adlib™, Windows 3.1™, MPC™. We could go on, but you get the picture.
- It's a Great Value — You get all this and more for a price that makes all other sound cards a blast from the past.

ADVICE.

PC MAGAZINE EDITORS' CHOICE
April 27, 1993
Pro AudioSpectrum 16

"It's the best all-around sound board you can add to your system, and it creates a standard to which both software and rival boards will aspire."
Most Valuable Peripheral Award,
PC/Computing, Dec. '92

"This is the best PC sound board..."
T. Yager, *Byte*, Dec. '92

"...one of the best all-around, affordable multimedia sound boards."
T. Carlton, *PC Games*, Mar. '93



"For my money, the PAS16 is the best deal going."
R. Lauriston,
PC World, Nov. '92

"The PAS 16 is currently the best deal available in a 16-bit card."
D. English, *Compute*, Jan. '93

COMPUTE CHOICE AWARDS
Best Peripheral 1992
Pro AudioSpectrum 16



"...Media Vision has done well with its Pro AudioSpectrum line, which is compatible with Sound Blaster, but I think is even better."
W. S. Mossberg,
Wall Street Journal, Oct. '92

"Those looking to add high-fidelity sound to their multimedia presentations should be pleased with this board's capabilities."
J. Quain, *PC Magazine*,
Sept. '92



Circle 113 on reader service card.

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Ultimate Upgrades

Essential peripherals that move data in and out of

Hey! You with the cart full of computer hardware—wait a minute!

You've followed our advice and chosen the right desktop systems for your office. You've made plans to improve on them with bigger monitors, faster graphics cards, monster hard drives, and tape drives to match. Yep, it looks like you've got the best, most complete, audacious PC systems money can buy.

Wrong.

You've assembled some powerhouse PCs that can juggle numbers, graphics, and words with equal speed and ease. But how are you going to get all those numbers, graphics, and words into the computer?

What you need is a way to reduce the drudgery and expense of inputting text, art, and data. The upgrade peripherals we look at do all that and also give your PC new capabilities that help you communicate ideas better.

We've chosen sound cards, scanners, modems, and pointing devices as the upgrade peripherals that provide the most significant business benefit beyond what your PC provides. Modems and mice have been around for some time, but the newer versions deserve careful consideration. Sound cards and scanners are relatively new breakthroughs; they integrate real-world sights and sounds so

DSP COMES TO SOUND

Digital signal processors speed up sound processing.

A sound board that supports a built-in DSP works faster because it takes some of the processing load off of the system's CPU.

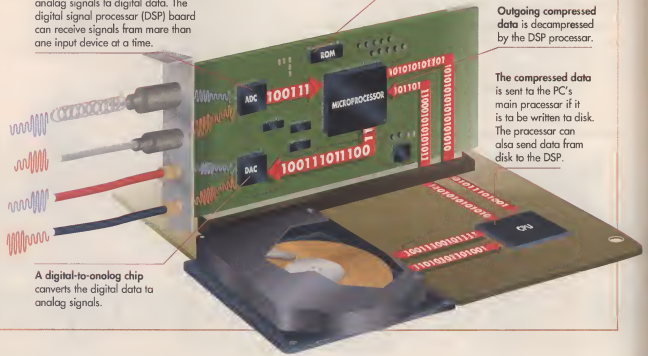


ILLUSTRATION BY ROSS SMITH

INSIDE...

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- Sound Cards 294
- Color Scanners 298
- Pointing Devices 304

your PC

that business applications can communicate better. Don't tread any further into the nineties without them.

Business Sound Cards: Voice for Your Work

Sound cards have been ubiquitous since 1987, adding the *ka-pow* and *swoooosh* to video games. What has turned them into useful business upgrades is the addition of simple microphones and the ability to record and play back sound. Windows, too, gets credit for adding another sensory dimension to the PC: Object linking and embedding (OLE) lets you embed sound objects in any application file. With smart, sound-aware applications, you can weave talking documents into a structured presentation or allow your audience to step through it on their own.

If you need to add only spoken messages to your documents, an 8-bit sound card will do. Music needs a card capable of 12-bit sound or, better yet, 16-bit sound. All the cards we tested were 12 bit or 16 bit (with the exception of one 10-bit card). The 12-bit cards we tested ranged from $250 to $300, and the 16-bit cards cost an average of $398, but prices are dropping fast. Higher prices generally mean better sound quality.

If you want music, you can choose between a card's WAV and MIDI capabilities. WAV is more commonly used in business applications, while MIDI is preferred for multimedia presentations. WAV files are provided with Windows 3.1. A 16-bit WAV file provides CD-quality sound—at a price. A one-minute, 16-bit WAV recording takes up to 10MB of hard disk space. A one-minute MIDI file, on the other hand, uses only about 20K. That's because it contains only the instructions for recreating the music, rather than the music itself. Your card should also be able to drop down to 8-bit sampling for recording speech, which produces adequate sound and saves disk space; all the cards we tested can do this.

Three of the top sound cards we tested have digital signal processing (DSP) technology, allowing your PC to produce sounds without slowing other operations. Onboard DSP lets your sound board compress and decompress digitized sound on the fly, so that your system's CPU doesn't slow down when sounds are replayed. (See "DSP Comes To Sound," facing page.) If you use big sound files, select a board with DSP to avoid sluggish presentations.

Finally, if you're buying on a budget, be sure to figure in the cost of a microphone, speakers, and sound clips. Only two of the winning cards we tested (from Creative Labs and Microsoft) included an inexpensive microphone. None of the winning cards included speakers, and although you can use your PC's speaker, you won't want to. Look for some bundling bargains as the sound card competition gets noisier.

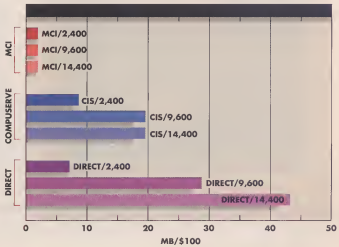
Cheaper and Faster Fax Modems

The prices of fax modems are dropping fast—at least $100 or $200 a year on the high end. Last year's 14,400-bit-per-second modems ranged in price from $700 to $1,400; this year's crop cost from under $200 to $1,099. So

HOW MUCH MODEM DO YOU NEED?

Faster isn't necessarily better.

If you use only MCI, $100 in charges buys the some services for o 2,400-bps or 14,400-bps modem. For modem-to-modem connections, however, o faster modem delivers more bang for the buck.



PRACTICAL PROTOCOLS

Demystifying high-speed communications standards.

What a difference a digit makes. Use our reference guide to choose the modem that's right for your needs. The bottom line: Get a modem that adheres to the appropriate CCITT standards to ensure that it can communicate with most modems throughout the world.

Modulation Protocols

V.22bis A protocol for sending data at 2,400 bps.

V.32 A protocol for sending data at 9,600 bps.

V.32bis A protocol for sending data at 14,400 bps. Both V.32bis and V.32 modems almost always include the data-compression protocol V.42bis and the error-control protocol V.42. (*Bis* indicates a second version.)

V.FAST A nickname for the next generation of modem communications. It's a protocol for modems communicating at 28,800 bps (twice as fast as V.32bis modems), but it hasn't been approved yet by the CCITT. It will be possible to layer V.42 and V.42bis on top of the V.FAST standard for error control and data compression, respectively. The V.FAST protocol is probably the last standard for modem communications across analog phone lines. To move beyond this speed, vendors will probably need to use newer digital technologies.

Data-Compression Protocols

V.42bis A standard for data compression that speeds up data transfer. V.42bis with a V.32bis modem should, in theory, perform at up to 57,600 bps. In practice, however, data transfer will be slower depending on the condition of the phone line and the compressibility of the data.

MNP5 An older standard that is analogous to V.42bis but doesn't compress data as efficiently.

Error-Control Protocols

V.42 A protocol that requests a packet be resent if errors are detected.

MNP4 Like V.42, this protocol requests a packet be resent if errors are detected. But this older protocol is not a CCITT standard.

should you wait until prices drop even more before grabbing a bargain? It depends on how often and in what situations you use fax modems (see "How Much Modem Do You Need?" page 281).

Although price reductions among 14,400-bps modems indicate that the market is maturing, all modems are not equal. Of the 48 modems we tested that support the latest ANSI and CCITT standards, nearly half failed to complete at least one suite of tests. The ones mentioned in our guide, however, passed all of our performance tests. At the very least, a modem should also support the Hayes AT command set; all the ones we tested do. And although many modems come bundled with communications software, a nonbundled program such as Crosstalk or Procomm Plus is generally a better choice.

Faxability A fax modem bundled with reasonably capable fax software offers instant productivity. We found WinFax Lite to be the best of the bundled fax programs. Find out if the software provides outbound fax broadcasting for sending the same fax to several locations, background sending and receiving so that your other work isn't interrupted, delayed sending to take advantage of long-distance night rates, and the ability to fax from within applications. A top-rated program like WinFax Pro (the full version of the Lite program found in many bundles) costs about $90 on the street and $129 list.

High-Speed Modem Tips One absolutely essential component if you intend to use a high-speed modem in the background under Windows is a 16550 universal asynchronous receiver/transmitter chip. This chip is found in the serial port of recent computer designs and onboard internal fax modems. Since the chip boosts the serial port buffer from 1 byte to 16 bytes, the modem interrupts your PC far less often, resulting in smoother background communications under Windows.

Check which transmission protocols your high-speed modem supports. Insist upon the modem having all three of these protocols: V.32bis, V.42, and V.42bis. For an explanation of the alphabet soup of protocols, see "Practical Protocols," above. All of the modems we tested had these capabilities, and together they provide faster data transfers with less chance of errors.

Scanners: Full-Page Color for Less

The paperless office may still be a distant dream, but a scanner can keep your business from drowning in paper.

It also allows you to establish databases of information that are readily accessed and manipulated.

Flatbed scanners have evolved from two extremes. On the low end are 300-dot-per-inch black-and-white scanners that do a moderately good job of scanning text for conversion with optical character recognition software. On the high end are 24-bit scanners capable of capturing millions of colors. The downward trend in pricing has pushed scanners capable of reading 16 million colors at 400 to 600 dpi into a price range within $500 of scanners that can't read color at all. This fact and the availability of inexpensive 24-bit video boards and color printers are making 24-bit color scanners the obvious buying choice.

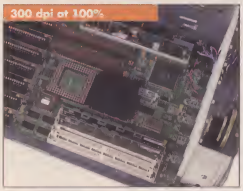
Ever the TWAIN If you forget all else about scanners when you go shopping for one, remember TWAIN. This new standard is the first step toward making scanners easier to operate, and scanner makers are adopting it in droves. There's also a trend among OCR, paint, and photo-editing software to offer TWAIN support.

It's easy to see why. Under TWAIN, all you need to do is select the software's Acquire command. A series of dynamic link libraries and drivers bring up scanning software as if it were a dialog box. This kind of seamless integration of the scanning software and the application makes scanners much easier to operate. In short, TWAIN stands to become the PCL 5 or PostScript of the scanning, OCR, and image-manipulation world. For this reason, we evaluated only TWAIN-compliant scanners.

How Much Resolution? Last year, the standard resolution for scanners was 300 dots per inch. This year 400

WHEN YOU NEED A 600-DPI SCANNER

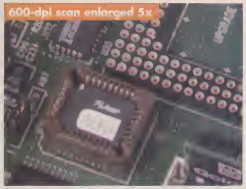
For most business needs, 300 dpi will do the job.





WHEN YOU DON'T NEED A 600-DPI SCAN: The photograph at left, scanned at 300 dots per inch, looks identical to the 600-dpi scan shown at right, both of which were output to film at 100 percent of original size and printed at 150 lines per inch (lpi). Because the optimal resolution of an image is never more than double the lpi, these images look alike. At 150-lpi (the resolution at which this magazine is printed), a 300-dpi scan is sufficient; the extra data in a 600-dpi scan is disregarded by the imagesetter.





WHEN YOU DO NEED A 600-DPI SCAN: Scanning at 600 dpi is crucial when you're enlarging images. In these photographs, there is a significant difference between the details in the two photographs, which have been enlarged 500 percent. Compare the smooth lines and the type in the detail of the 600-dpi scan to the right to the pixellated details in the 300-dpi scan at the left.

dpi and 600 dpi are becoming more common. Do you need them? That depends on what you're going to finally do with the scanned image. See "When You Need a 600-dpi Scanner," page 283. One thing is certain—OCR is noticeably more efficient at higher resolutions. Nobody should consider scanning text for OCR at anything less than 400 dpi. Line art, such as logos and technical diagrams, also benefits from scanning at higher resolutions, particularly if you plan to enlarge the image. And for best-quality output, such as photographic scans you plan to send to a print shop or service bureau, the 600-dpi standard is as important as color. But if you're mainly scanning photographs for onscreen viewing or for same-size output on a laser printer, anything higher than 300 dpi could be overkill. Expect to pay around $1,500 for a 400-dpi scanner—and add another $800 for 600-dpi or higher resolution.

The bottom line: If you intend to run OCR software or scan line art, or send anything you've scanned to a professional printer, buy a 400-dpi or higher-resolution scanner.

Pointing Devices: Good, Bad, and Strange

If you bought a PC in the last year or two, you already own a mouse. But then, there's always a better mouse, and the 41 devices we tested—priced from $29 to $300—allow you to perform widely diverse tasks, from simple pointing and clicking to detailed technical illustration. For a grand tour, see "Pointing Devices to Suit Every Style," at right.

Clicking vs. Drawing A wide chasm separates those who use a pointing device to point and click on the occasional Windows icon or menu from those who require the control of a pen. For the computer artist, a drawing tablet stylus is the answer. For the person with simpler drawing needs who also requires Windows pointing, there are less expensive devices that can be held like a pen but don't require a wired tablet to draw on.

Pointing devices are also important for portable computing. You need something that you can operate in an airline seat without borrowing your neighbor's lap. A number of small trackball devices and a few pressure-sensitive pads will do the trick, although none is ideal. There are also desktop-size trackballs and cordless mice for the hopelessly messy. Beyond these distinctions lie gimmicks and downright bad ideas. Our advice: Test-drive the most promising options.

Pointing Devices to Suit Every Style

Peripherals that go beyond the plain-vanilla mouse.



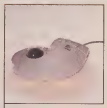
MS Mouse Style

Application: General use.

Specifications: Hand-guided with buttons; 8 to 12 square inches; $10 to $150.

Pros: Easy to install and operate; simple point and click.

Cons: Low resolution.



Trackball

Application: General use.

Specifications: Finger-operated sphere; up to 50 square inches; $80 to $300.

Pros: Better control than mouse; less likely to get in the way or be dropped.

Cons: Low resolution; poor choice for travel.



Portable Trackball

Application: Portable computing.

Specifications: Small finger-operated sphere; 10 square inches or less; $50 to $150.

Pros: Usually clips onto keyboard; accurate and convenient for travel.

Cons: Some response may be lost.



Stylus

Applications: Travel, graphics, CAD.

Specifications: Pen-mounted, mouselike mechanism; 1 square inch by 6 inches long; $60 to $200.

Pros: Fine control for better detailing in graphics or design.

Cons: Limited resolution.



Digitizer Tablet

Applications: Graphics, CAD.

Specifications: Mouse or stylus sensor pad; 25 to 300 square inches; $100 to over $10,000.

Pros: High resolution for detailed graphics.

Cons: Not for general applications.



Unusual

Applications: General use and data entry.

Specifications: Input method varies; some small, some hand-held; $70 minimum.

Pros: Innovative designs solve problems not met by mainstream devices.

Cons: Requires a steep learning curve.

PHOTOGRAPHS BY ERIC FRIEDLANDER

You Name It.

TAKE YOUR CHOICE OF DESKTOP, LAPTOP OR NOTEBOOK KEYBOARDS WITH INTEGRATED POINTING DEVICES IN AWARD-WINNING DESIGNS.



25mm Trackball with duplicate controls on rear of keyboard



25mm Trackball above the LED

PC MAGAZINE EDITORS' CHOICE February 25, 1992 Lexmark Enhanced 101 Key Keyboard

PC MAGAZINE MVP FINALIST

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AVAILABLE IN 35 LANGUAGES AND VIRTUALLY ANY COLOR OR GRAPHICS. MADE IN THE U.S.A.



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LANGUAGES

You name it.

Demandez, vous l'aurez

Sagen Sie uns, was Sie brauchen

Basta chiedere, e l'avrete

Usted dira

Слово за Вами!

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NETWORKING FOR THOSE TRYING TO RUN A BUSINESS. NOT A COMPUTER.



If you're a Windows user, Windows for Workgroups is the easiest way to network. If you're not using Windows, it's one of the best reasons to start.

No matter what business you're in, you stand to do a lot more of it when all your PCs are working together. And Microsoft® Windows™ for Workgroups is the easiest way to connect them.

Everyone benefits from a network. You can share letters and memos. And you can share one printer instead of buying several. Groups can develop reports together. Departments can work on common files. And everybody can have access to the latest (up-to-the-nanosecond) customer database or even an accounting system. Of course, Windows for Workgroups has security features in case you don't want everybody up on all the latest.

We could tell you how well Windows for Workgroups works. But it might be more convincing if you heard it from someone like you, who doesn't have a lot of time to spend running computers.

Crest Oelke at Dairy Queen of Greater St. Louis decided on Windows for Workgroups after watching 4 of his employees try to manage the accounting for 3 operations. Now they don't have to enter the same inventory, payable and receivable data into several PCs. Instead, they enter it once into their accounting package and it's a done deal, making everyone's life a lot easier.

Over the next year, Crest figures he'll save around $30K. Money that might be spent on more important things. Like ice cream.

Getting started is easy. Both in effort and in money spent. You can do it yourself. Or we can put you in touch with someone who can help.

Call us at (800) 426-9400, Department JM7.

And start networking with Microsoft Windows for Workgroups. You'll be amazed how little time you spend on your PC.

And how much more time you can spend on your business.





Left: Windows for Workgroups makes it easy for groups to share files and information. Right: Which makes it much easier for you to show a profit.

Microsoft
Making it easier

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HIGH-SPEED FAX MODEMS

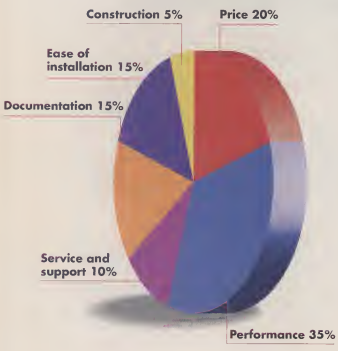
Speedy communications and fast faxing

No PC should be an island. If you don't have a modem, you can't connect to other people and other sources of data in the ever-expanding world of online information. High-speed modems are the computer world's response to the business adage "Time is money." All things being equal, 14,400-bit-per-second (also called V.32bis) modems transfer 1MB of data between two PCs six times faster than 2,400-bps modems.

To qualify for inclusion in the *PC/Computing* 200, a high-speed modem had to support the V.32bis standard for communication between modems. The modem also had to support both the V.42 standard for error control and the V.42bis standard for data compression. With support for all of these protocols, the modem is theoretically able to transfer data as fast as 57,600 bps, although you'll never see transfer rates that high because of protocol overhead and the limits of data compression. Finally, we required that the modem send and receive fax transmissions. Of the 48 modems that met our qualifications, seven made the list of winners.

DECIDING FACTORS

Ultrafast performance is the first priority in choosing a fax modem, but check the price tag, too.



Factors and Weights

Your goal with any modem is to transfer data as fast as possible. So it should come as no surprise that each modem's **performance** accounts for 35 percent of the product's score. This score covers such factors as best-case throughput, impaired-line testing times, and fax transmission and reception times. Of course, super speed at an outrageous price doesn't help you, so **price** rates 20 percent of the total score.

Also important is the quality of the **documentation** (15 percent of the total). Working with IRQs and assorted dip switches and jumpers calls for a manual that's well organized and well illustrated. If you can't install the fax modem, you can't use it, so **ease of installation** also accounts for 15 percent of the overall score. The vendor's **service and support** accounts for 10 percent. This score reflects the length of the warranty, the availability and cost of technical support, and the availability of BBS support. Finally, we considered the quality of **construction** (5 percent of the total). Modems that are housed in steel or aluminum cases tend to last longer than those in plastic cases.

How We Tested

To gauge the modems' performance, we hooked them up to a telephone-line simulator and ran them through several scenarios. First, we set up a perfect-line condition—no noise or impairments—and transferred several kinds of files between them. Then we added line impairments to simulate both land-based and satellite-based long-distance lines. Finally, we sent a fax document from each fax modem to a standalone fax machine and measured the modem's performance.

To rate the quality of the documentation, the ease of installation, and the quality of construction, we considered whether the modem came with a quick-start guide, whether the fax modem supported COM ports 1 through 4, and whether it included a phone cord so that you could get started right away.

PC/COMPUTING DECISION MAKER

How to buy the high-speed fax modem that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Price	Performance	Ease of installation	PM14400FXMT
		Documentation	Digicom ScoutPlus
	Service and support	Ease of installation	PM14400FXMT
		Documentation	Digicom ScoutPlus
Performance	Service and support	Ease of installation	PM14400FXMT
		Documentation	SatisFaxtion Modem/400
	Price	Ease of installation	PM14400FXMT
		Documentation	Digicom ScoutPlus
Service and support	Price	Ease of installation	PM14400FXMT
		Documentation	SatisFaxtion Modem/400
	Performance	Ease of installation	PM14400FXMT
		Documentation	SatisFaxtion Modem/400

PC Computing BEST

HIGH-SPEED FAX MODEM

Digicom's ScoutPlus: an all-around performer.

Our top-scoring high-speed fax modem, the Digicom ScoutPlus, rated consistently high. The ScoutPlus comes with impressive documentation, DOS and Windows-based fax software, and DOS-based communications software. This fax modem package has everything that you need to get going with telecommunications. By balancing a reasonable price with good performance and features, the ScoutPlus earns our selection as the best fax modem in the *PC/Computing* 200.

ScoutPlus • Digicom Systems • 188 Topaz St., Milpitas, CA 95035 • (800) 833-8900, (408) 262-1277 • $389



BEST PERIPHERALS

HIGH-SPEED FAX MODEMS

Rank	Product	Pros and Cons	Performance* 35%	Price 20%	Documentation 15%	Ease of installation 15%	Service and support 10%	Construction 5%	Total Score
1 PC Computing BEST	**ScoutPlus** Digicom Systems 188 Topaz St. Milpitas, CA 95035 (800) 833-8900 (408) 262-1277 $389	**Pros:** Reasonable price; excellent documentation; good performance. **Cons:** Inferior construction quality.	9.1	9.2	10.0	8.5	8.4	8.2	**90.5**
2	**Boca 14.4 Kbps Modem** Boca Research 6413 Congress Ave. Boca Raton, FL 33487 (407) 997-6227 $495	**Pros:** Very simple installation procedure; easy to get started. **Cons:** Inferior construction quality.	8.9	8.8	8.8	10.0	9.2	8.2	**90.3**
3	**SolisFaxtion Modem/400** Intel Corp. 5200 N.E. Elam Young Pkwy. Hillsboro, OR 97124 (800) 538-3373 (503) 629-7354 $499	**Pros:** Top-notch documentation, support, and construction; good DOS communications software and Windows fax software; intelligent built-in line sharing. **Cons:** Difficult installation.	9.0	8.8	10.0	7.3	10.0	10.0	**90.1**
4	**PM14400FXMT** Practical Peripherals 375 Conejo Ridge Ave. Thousand Oaks, CA 91361 (800) 442-4774 (805) 497-4774 $399	**Pros:** Reasonable price; very good performance; lifetime warranty; supports class 1 and II software and caller ID; good software bundle. **Cons:** Inferior construction quality.	9.2	9.2	8.5	8.5	9.5	8.6	**89.9**
5	**Sportster 14,400 Fox** U.S. Robotics 8100 N. McCormick Blvd. Skokie, IL 60076-2999 (708) 982-5010 $549	**Pros:** Excellent documentation; good service and support; easy installation. **Cons:** So-so performance; inferior construction quality.	8.6	8.6	10.0	9.2	9.2	8.2	**89.4**
6	**ZyXel U-1496E** ZyXel 4920 E. La Palma Ave. Anaheim, CA 92807 (800) 255-4101 (714) 693-0808 $469	**Pros:** Good performance; runs at 16.8 Kbps with other ZyXel modems; supports caller ID; callback security; digitized-voice support. **Cons:** Below-average documentation and suppart.	9.2	8.9	8.1	8.9	8.1	8.6	**87.9**
7	**PM14400FXSA** Practical Peripherals 375 Conejo Ridge Ave. Thousand Oaks, CA 91361 (800) 442-4774 (805) 497-4774 $549	**Pros:** LCD displays transmission progress and communication status; lifetime warranty; good software bundle. **Cons:** Inferior construction quality.	9.0	8.6	8.5	8.5	9.5	8.2	**87.8**

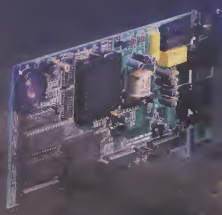
* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

Times Square meets modem technology.

If your modem's screeching sounds ond stotus lights meon less thon nothing to you, you'll oppreciote the 12-chorocter bocklit LCD disploy on **Practical Peripheral's PM14400FXSA**. This nifty feature gives you reol-time informotion obout the stotus of your coll, whether you're trons-mitting severol megobytes to the home office or shooting out lost-minute foxes. And if you ever hove problems connecting to o host, you'll stond o better chonce of diognosing the difficulty with the English-longuoge stotus descriptions thon with the normal orroy of red ond green lights. Why should you leorn your modem's longuoge when there's one thot speoks yours?





"Recommended."
Jerry Pournelle, Byte, July 1992

Inside Out

SupraFAXModem V.32bis Internal
$349.95 Dos/Windows



The Best Choice: SupraFAXModem

Inside or Out, now you can choose the hot-selling **SupraFAXModem** technology that best fits your computer. Either way, Supra can turn your PC into a communications powerhouse!

SupraFAXModems come in a wide range of models, from our budget-minded **SupraFAXModem** 24/96i to the fastest fax modem available: the **SupraFAXModem** V.32bis. Whichever model you choose, you will get Supra's proven technology and reputation for high-quality, reliable modems.

Supra modems are designed for novice and expert communicators alike. Whether you use DOS™, Windows™, or a Macintosh™, we've got a package for you — and our packages include everything you need. Plus our easy-to-follow Getting Started manuals will help you install your modem and start using it in just a few minutes! Imagine sending and receiving perfect faxes, exploring the world of on-line databases, or retrieving an important work file — all from the convenience of your desk. And advanced users will appreciate the error-correction and data-compression features that can save you money!

SupraFAXModem V.32bis External
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$439.95 Dos/Windows



Supra Corporation
Circle 109 on reader service card.

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MODEL	INT./EXT.	FAX	DATA	V.42bis & MNP 5	MAX THROUGHPUT
SupraFAXModem V.32bis	E,I	14,400 S / R	14,400	yes	57,600
SupraFAXModem Plus	E	9600 S / R	9600	yes	38,400
SupraFAXModem Plus	E	9600 S / R	2400	yes	9600
SupraFAXModem 24/96i	I	9600 S / R/HDLC	2400	w/ software	9600

DOS Package includes modem, Fax Talk™ Plus, COMIT™, cables, manuals • **Windows Package** includes modem, Winfax™, cables, manuals

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Featuring Rockwell Modem Technology

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PRESENTING THE T4

REST ON THEM.



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PC MAGAZINE TECHNICAL EXCELLENCE

WINNER Toshiba T4400SXC

Our T4400C's forefather, the legendary T4400SXC, captured PC Magazine's Technical Excellence and Editors' Choice Awards, PC World's World Class Award, and Byte's Award of Excellence



The new T4400C is available with a blazing 25 MHz 486DX processor.



With our T4400C, you have a choice of either a 200MB or 120MB hard drive.



Our T4400 series features our MaxTime power management system that gets the maximum out of every battery charge.

Immediately after capturing the "Editors' Choice" award from *PC Magazine* for our T4400SXC, we asked our engineers to better it.

They responded with the T4400C. A notebook that redefines what is possible in 486 color technology.

Take for example its TFT-LCD active matrix color screen. We pioneered this technology and now we've advanced it even further by enlarging the screen to a full 9.5 inches. Amazingly, it provides an eyeball-popping 256 simultaneous colors at 640 x 480 resolution from a palette of 185,193 colors, making it the best TFT color display on the market.

If you think that's impressive, check what's under the hood. You'll find a choice of either a blistering new 25 MHz 486DX processor with a massive 200MB hard drive or the renowned 25 MHz 486SX with a 120MB hard drive. And both offer 4MB RAM expandable to 20MB.

Of course, if your needs are more modest, we offer a T4400SX with a large 9.5" monochrome LCD screen, a not-so-modest 25 MHz 486SX microprocessor and 120MB hard drive.

Our engineers even extended battery life. By offering such MaxTime™ power management features as automatic display and hard drive shut down, AutoResume and AutoSave.

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Circle 215 on reader service card.

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SOUND CARDS

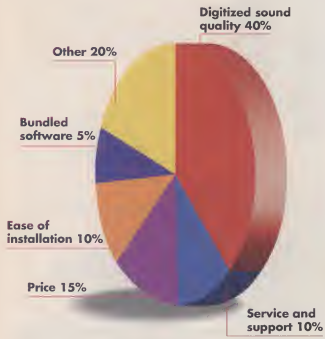
Upgrades that add a new dimension to the PC

The newest tool in your business computing arsenal, PC audio, lets you put multimedia to work. Create captivating presentations by incorporating sound into the production, use Windows object linking and embedding to put business applications in your own words, or take advantage of audio-enhanced applications. Although cheap 8-bit boards can be used for low-quality recording and playback, a high-end system calls for a quality 16-bit board. These high-performance cards give your computer MPC sound compatibility and provide a solid foundation for a voice-annotation or voice-messaging system.

The 16-bit sound boards we evaluated can record with at least 10-bit precision. All the boards use 16-bit processors and include inputs for external audio as well as at least one stereo audio output. The boards could digitize audio at sampling rates of up to 44.1KHz. All boards tested were ISA bus, although this was not a criterion for selection. No external devices (connecting through the computer's parallel port) met the 16-bit requirement. Of the nine boards that met our criteria, five made the list of winners.

DECIDING FACTORS

Digitized sound quality is by far the most important factor in choosing a sound card.



Factors and Weights

Digitized sound quality accounts for 40 percent of the score: If a board can't record and play sound and music that spans the human range of hearing (20Hz to 20KHz) in stereo with a minimum of distortion or error, no software enhancements can correct the weaknesses.

Next in our list comes **price** at 15 percent—the products tested cover a broad range and include some good performers at the lower end. Scores for **ease of installation,** which account for 10 percent of the total score, varied widely. Installation times ranged from 30 minutes to a full day, and a surprising number of boards required jumper changes, undocumented settings, or lengthy calls to technical support. Also worth 10 percent is **service and support,** which takes into account the warranty and the technical-support policies. Other factors are the **ability to play music** (5 percent) in both MIDI and other standard formats; **sound controls** (5 percent), including MPC-compatible mixing capabilities; **bundled software** (5 percent), which ranges from basic setup software to CD-ROM multimedia encyclopedias and commercial multimedia authoring packages; **bundled hardware** (5 percent), including headphones, connection cables, and microphones; and **documentation** (5 percent).

How We Tested

We installed the boards on a Compaq 386DX/33 system with 4MB of RAM, running DOS 5.0 and Windows 3.1. To evaluate the accuracy of sound output, we used the Audio Precision System One (APSO) sound analyzer. We used an NEC Intersect CDR-84J CD-ROM to play the CBS Test Record CD, a standard signal source. We recorded sound signals produced by the CBS CD at three sampling rates (11KHz, 22KHz, and 44KHz) and evaluated playback quality using the APSO. We installed and ran sound-control software and bundled software, noting installation procedures. MIDI playback quality was also taken into account.

PC/COMPUTING DECISION MAKER

How to buy the best sound card that's best for your business.

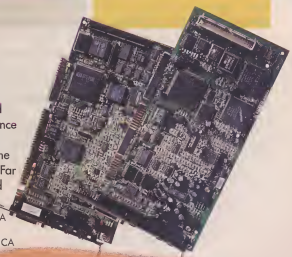
1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Digitized sound quality	Sound controls	Bundled software	Turtle Beach MultiSaund
		Ability to play music	Turtle Beach MultiSaund
	Ability to play music	Sound controls	Saund Blaster 16 ASP (with Wave Blaster board)
		Bundled software	Saund Blaster 16 ASP (with Wave Blaster board)
Service and support	Ease of installation	Price	Pra AudiaSpectrum 16
		Documentation	Pra AudiaSpectrum 16
	Price	Ease of installation	Pro AudiaSpectrum 16
		Documentation	Pra AudiaSpectrum 16
Price	Bundled software	Digitized saund quality	Saund Blaster 16 ASP
		Service and support	Pro AudiaSpectrum 16
	Digitized sound quality	Bundled software	Saund Blaster 16 ASP
		Service and support	Saund Blaster 16 ASP

PC Computing BEST

SOUND CARDS

Pro AudioSpectrum 16 and Sound Blaster tie.

The Pra AudiaSpectrum 16 and the Saund Blaster 16 ASP finished neck and neck. The $349 SaundBlaster 16 ASP's digital performance was among the best, and when you want archestra-quality saund, you can add a Wave Blaster MIDI daughterbaard for $249.95. The Pra AudiaSpectrum 16 has a great high-end frequency response. Far mast users this $299 baard shauld meet all multimedia audio (and SCSI cantral) needs for same time ta came.



Sound Blaster 16 ASP • Creative Labs • 1901 McCarthy Blvd., Milpitas, CA 95035 • (800) 998-5227, (408) 428-6600 • $349

Pro AudioSpectrum 16 • Media Visian • 3185 Laurelview Court, Fremont, CA 95438 • (800) 348-7116, (510) 770-8600 • $299

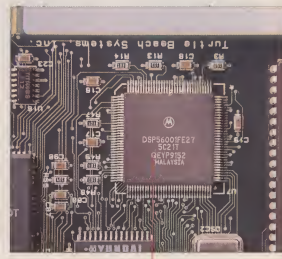
Rank	Product	Pros and Cons	Digitized sound quality 40%	Price 15%	Ease of installation 10%	Service and support 10%	Bundled hardware 5%	Bundled software 5%	Documentation 5%	Ability to play music 5%	Sound controls 5%	Total Score
1 COMPUTER LIFE BEST	**Sound Bloster 16 ASP** Creative Labs 1901 McCarthy Blvd. Milpitas, CA 95035 (800) 998-5227 (408) 428-6600 $349	**Pros:** DSP supports fast compression; good hardware and software bundle; optional daughterboard for superior quality MIDI. **Cons:** Works with limited number of CD-ROMS.	9.5	9.0	8.8	8.5	8.9	9.4	8.1	7.6	6.2	**88.9**
1 COMPUTER LIFE BEST	**Pro AudioSpectrum 16** Media Vision 3185 Laurelview Court Fremont, CA 95438 (800) 348-7116 (510) 770-8600 $299	**Pros:** Good performance; support for seven SCSI devices; strong warranty. **Cons:** Requires adopter for high-quality MIDI; locks o digital signal processor.	8.4	9.6	9.3	10.0	7.9	7.8	10.0	7.6	9.8	**88.9**
3	**Microsoft Windows Sound System** Microsoft One Microsoft Woy Redmond, WA 98052 (800) 426-9400 $289	**Pros:** Good performance; includes microphone, headphones, and good software bundle. **Cons:** No MIDI support; not designed to support Sound-Blaster or Adlib sound files.	8.4	9.7	9.3	8.1	10.0	7.8	10.0	7.4	7.5	**86.9**
4	**Turtle Beach MultiSound** Turtle Beach Systems 1600 Pennsylvonia Ave. Suite 33 York, PA 17404 (717) 843-6916 $599	**Pros:** Very high performance; excellent MIDI. **Cons:** High price.	9.3	6.3	9.0	8.8	7.9	8.6	9.4	8.9	9.1	**86.4**
5	**Creative Labs Sound Blaster 16 ASP with Wave Blaster** Creative Labs 1901 McCarthy Blvd. Milpitas, CA 95035 (800) 998-5227 $598.95	**Pros:** Excellent performance and DSP; high-quality sampled MIDI (as well os FM). **Cons:** More costly than boards without sampled MIDI.	9.5	6.3	8.8	8.5	8.9	9.4	8.1	9.6	6.2	**85.9**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

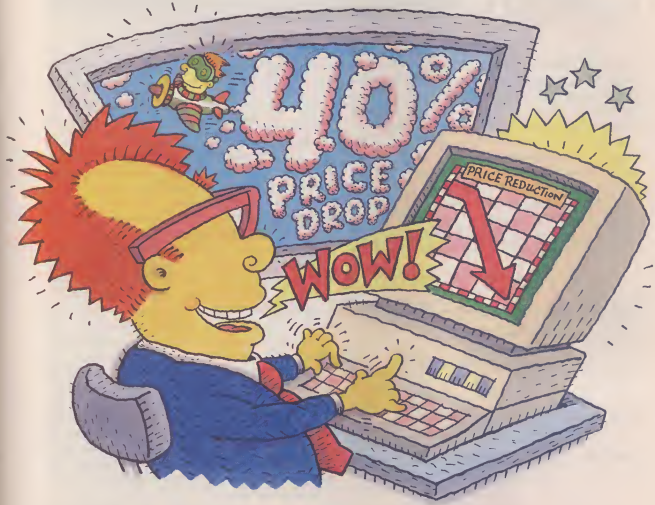
Increase speed and flexibility with onboard DSPs.

Turtle Beach's MultiSound and **Creative Labs' Sound Blaster 16 ASP** are set apart fram the ather winning baards because they each have a digital signal pracessar (DSP) that acts as a saund capracessar. The MultiSaund uses the Matarala madel shawn here, and the Saund Blaster 16 ASP's is prapietary. Bath affer a performance baast by taking an saund-file processing and freeing up yaur CPU far ather tasks. DSPs alsa pravide file campressian, which is helpful with unwieldy saund files. But DSPs affer even more than performance gains: They provide flexibility and functionality because they're saftware programmable. You can add features like vaice recagnitian ta a card with a simple software upgrade.

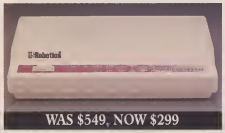


Digital signal processor

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COLOR SCANNERS

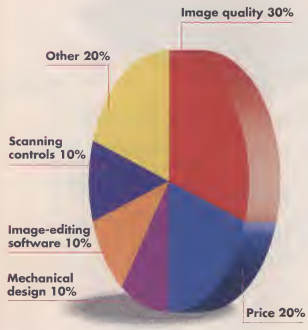
For text and images, an all-purpose business tool

High-resolution color scanners aren't just for the art department anymore. Document image management and optical character recognition thrive on high-resolution scans, and presentations need good color—the scanners that made it through our rigorous testing provide both.

To qualify for testing in the *PC/Computing* 200, scanners had to be flatbed models capable of 24-bit color (16 million colors) at resolutions of 400 or 600 dots per inch (on either the horizontal or vertical axis). No scan with fewer than 24 bits of color can reproduce photographic images or subtle gradations—and as in the printing world, the standard scanner's resolution has increased from the former baseline of 300 dpi over the past 18 months. We also insisted that scanners comply with the new TWAIN standard. We tested 12 scanners and wound up with 6 winners.

DECIDING FACTORS

Accounting for nearly a third of the score, image quality is paramount in choosing a scanner.



Factors and Weights

Because the quality of the end result is paramount, 30 percent of each scanner's final score depends on **image quality**—color and gray intensity, image sharpness, and the quality of shadows and highlights. Next in importance is **price** at 20 percent—with prices ranging from $1,000 to more than $2,100, it's a key factor in a decision.

Mechanical design (10 percent) reflects the speed of the scanning engine. We favor energy-conscious one-pass color scans and machines that power their lamps only when scanning. Because software design is as important as hardware design, especially in controlling the scanner, **scanning controls** rate at 10 percent—including zoom and color-preview options, buffering, and resolution (including interpolation). Also worth 10 percent is **image-editing software**, which provides after-scan image controls. Our scoring reflects global and area image-manipulation controls, as well as the number of available file formats.

We rate **service and support** at 5 percent, and two related factors—**documentation** quality and **ease of installation**—weigh in at 5 percent each. Finally, we allot 5 percent for **upgrade options**—specifically, transparency units and multiple document feeders—and rate user-installable ones higher.

How We Tested

Using each scanner's TWAIN driver, ZD Labs scanned gray and color images to test both speed and quality of the hardware. Using results from three separate scans, we calculated the rate at which each scanner transferred data from hard copy to the PC in kilobytes per second. We then printed the images on a Tektronics Phaser IISD dye-sublimation printer. A panel of six people, including magazine production professionals, assessed image intensity, clarity, jitter, highlights, and shadows.

We evaluated the clarity of the scanner's optics with a line-art "real resolution" test—scanning a well-focused photograph with fine converging lines. This helped us determine the scanner's effective resolution and provided a touchstone for the quality of interpolation (a method that takes a 400-dpi scan and mathematically increases the resolution to 1,200 or more dpi).

PC/COMPUTING DECISION MAKER

How to buy the color scanner that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Image quality	Scanning controls	Mechanical design	HP ScanJet IIc
		Image-editing software	Epson ES-800C
	Image-editing software	Scanning controls	Microtek ScanMaker IIxe
		Mechanical design	HP ScanJet IIc
Price	Image quality	Mechanical design	Microtek ScanMaker II
		Scanning controls	Microtek ScanMaker II
	Image-editing software	Scanning controls	Mustek ColorArtist II
		Service and support	Microtek ScanMaker IIxe
Mechanical design	Image quality	Upgrade options	Epson ES-800C
		Scanning controls	HP ScanJet IIc
	Price	Image quality	Epson ES-800C
		Service and support	Epson ES-800C

PC Computing BEST

COLOR SCANNER

Epson's ES-800C wins the gold.



The Epsan ES-800C is a good all-araunder and finds strength in its consistency. Installatian and aperation were a breeze. Its calar and grayscale scans were sharp, faithful repraductians, with especially good highlights and shadows. The line-art scans in aur real-resolutian tests proved the Epsan has the best cambinatian af aptics and interpalatian software in the roundup. Its fast, ane-pass calar scans came a clase secand to the HP ScanJet's in stapwatch tests. And the campany backs it all up with reasanable pricing and strang service and suppart.

Epson ES-800C • Epson America • 20770 Madrona Ave., Torrance, CA 90503 • (800) 289-3776, (310) 782-0770 • $1,899

Rank	Product	Pros and Cons	Image quality 30%*	Price 20%	Image-editing software 10%	Mechanical design 10%	Scanning controls 9%	Documentation 5%	Ease of installation 5%	Service and support 5%	Upgrade options 5%	Total Score
1 PC Magazine BEST	**Epson ES-800C** Epson America 20770 Madrona Ave. Torrance, CA 90503 (800) 289-3776 (310) 782-0770 $1,899	**Pros:** Sharp images; fast, one-pass engine, low price; excellent interpolation. **Cons:** No scanning buffer.	9.6	8.7	9.0	9.6	9.3	9.6	9.6	9.4	10.0	**93.4**
2	**HP ScanJet IIc** Hewlett-Packard 3000 Hanover St. Palo Alto, CA 94304 (800) 752-0900 (415) 857-1501 $1,995	**Pros:** Fastest scanning engine; best overall design; high-quality images; fine interpolation. **Cons:** Expensive; too-bright highlights.	9.4	8.6	10.0	9.9	9.9	10.0	10.0	8.9	5.0	**92.2**
3	**Microtek ScanMaker II** Microtek Lab 680 Knox St. Torrance, CA 90502 (800) 654-4160 (213) 321-2121 $949	**Pros:** Highest-scoring images; lowest price; easy installation. **Cons:** No-frills image-editing software; slow scanning; average documentation.	10.0	10.0	8.7	7.9	7.7	9.3	10.0	8.3	4.0	**90.1**
4	**AVR 8000** AVR Technology 71 E. Daggett Dr. San Jose, CA 95134 (800) 544-6243 (408) 434-1115 $2,195	**Pros:** Great service and support; high-quality images; sturdy, lightweight design. **Cons:** Slow three-pass scanning; expensive.	9.6	8.4	9.2	8.1	7.3	9.8	9.2	10.0	10.0	**89.7**
5	**Microtek ScanMaker IIXE** Microtek Lab 680 Knox St. Torrance, CA 90502 (800) 654-4160 (213) 321-2121 $1,695	**Pros:** Highest-rated images; excellent image-editing software; easy installation. **Cons:** Slow; expensive.	10.0	9.0	9.4	7.9	7.7	9.3	10.0	8.3	4.0	**88.8**
6	**Mustek ColorArtist II** Mustek 15225 Alton Pkwy. Irvine, CA 92718 (800) 468-7835 (714) 453-0110 $1,295	**Pros:** Good scanning and image-editing software; low price. **Cons:** Slow three-pass scanning; lackluster image quality; noisy.	8.1	9.5	9.6	7.4	9.2	8.9	8.4	8.3	5.0	**84.8**

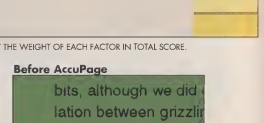
* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

CLOSE-UP: DESIGN IN DETAIL

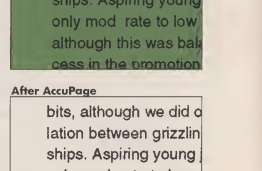
AccuPage delivers more than meets the eye.

Which of these text scons is easier for you to reod? Your OCR progrom ogrees with you. So whot if you wont to scon text for OCR from a colored background? Use the **HP ScanJet IIc**, which incorporotes AccuPoge technology. This technology effectively drops out color backgrounds and sharpens up faint dot matrix print—to moke almost ony sconned text OCR reody.

Before AccuPage



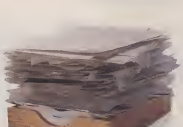
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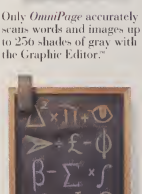
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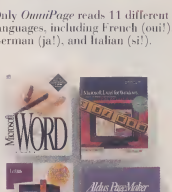
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When it comes to OCR (optical character recognition), no other product can match the overall performance of *OmniPage* Professional. That's why 8 out of 10 business professionals consistently choose *OmniPage* Professional over all other options. Only *OmniPage* Professional has the full capabilities to *accurately* scan virtually any document into almost any word processor, spreadsheet, or database file. So you can use *OmniPage* Professional to accurately scan newspaper articles, business reports, journals or legal documents. It's not surprising then that 8 out of 10 scanners in the world have shipped with a trial version of *OmniPage*, including those from Hewlett-Packard, Epson, Microtek,™ and Apple. Why would they be any different than the rest of us?

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Circle 272 on reader service card.





TO DESIGN OUR NEW MOUSE, WE STARTED BY READING PALMS.

In relentless detail, we studied hands of all dimensions.

We consulted professors of kinesiology, engineers, ergonomists and computer users. We used digital fiber optics to analyze the human hand. We followed it in motion.

The result is a new Microsoft® Mouse that is, well, anatomically correct. Uncommonly comfortable.

The palm is perfectly supported. Left or right handed, the grip is comfortable. Fingertips fall naturally into place. A click feels just right.

This mouse even looks good. Intriguingly asymmetrical. Yet it somehow reminds you of the gentle curves of a human form.

Did we mention that it also has some innovative new software features? They allow you to customize the mouse, so it works the way you like to work.

Try the new Microsoft Mouse. If you're not comfortable, we'll refund your money. Guaranteed. Details are on the box, which you can quickly get your hands on at a computer store near you.



Microsoft
Making it easier

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POINTING DEVICES

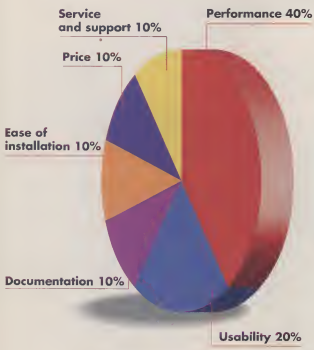
Which input device is most usable?

GUIs are making keyboard-only input a thing of the past. A large proportion of most data entry and manipulation may still be accomplished through the keyboard, but GUIs have opened up a whole new realm of human-machine interaction, making applications easier to use and more productive.

A lot of that gain in ease of use and productivity depends not on the GUI, however, but on the pointing device you use with it. While there was a time when if you'd tried one mouse, you'd tried them all, the market today is filled with a broad spectrum of devices. Which type is best? It depends on what you want to do and how you want to do it—and what you're willing to spend.

DECIDING FACTORS

A pointing device should make work easier, so performance and usability are the top priorities.



For the *PC/Computing* 200, we set out to determine the best among the new crop of pointing devices. To qualify, each device needed to connect to the computer without the use of an extra adapter card, and it had to cost less than $300. We started out with a field of 41, and 12 went on to the winners list.

Factors and Weights

Performance, combining both accuracy and responsiveness, is the factor that users of a new pointing device consider most heavily. As a result, we weighted performance at 40 percent of the overall total. **Usability**, rating next in importance at 20 percent, takes into account each pointing device's ease of use as well as the users' comfort and overall satisfaction.

The remaining factors were all weighted equally at 10 percent. Pointing devices vary greatly in **price**; while it's always a factor in any purchase, it may not always offer a reference point for determining a product's merits. Scores for **documentation** reflect the usefulness of the printed materials that come with the device and the quality of the software's online help. Good manuals were well written and illustrated, and provided troubleshooting and error-handling sections. **Service and support** takes into account the methods available for obtaining troubleshooting information. High scores go to companies that offer toll-free telephone support, a BBS, and at least a one-year warranty. Products scored highly for **ease of installation** when hardware and software installation routines were well designed, proper mounting accessories were included, and device defaults were sufficient to get products up and running quickly without further modification.

How We Tested

We unpacked and installed each device according to the documentation accompanying it. We noted device dimensions, construction quality, overall design, and mounting hardware included.

Quantifying a pointing device's performance was a challenge. A pointing device testing utility developed by Home Row helped. With it, we were able to test accuracy and response by measuring the time that elapsed between clicking on two icons. We did this 100 times. Only successful attempts to click the icons counted. To gauge usability, we employed the *PC/Computing* Usability Lab's standard Usability Satisfaction Questionnaire.

PC/COMPUTING DECISION MAKER

How to buy the pointing device that's best for your business.

1. Choose the factor that's most important to you.	2. Choose the next most important factor.	3. What else is important?	4. For your needs, the best product to buy is...
Performance	Usability	Price	MicroTrak
		Service and support	System Mouse
	Price	Usability	System Mouse
		Service and support	Pet Mouse
Usability	Performance	Ease of installation	MicroTrak
		Service and support	System Mouse
	Price	Service and support	Pet Mouse
		Documentation	Pen-Shaped Mouse
Documentation	Usability	Service and support	AceCAD D9000
		Ease of installation	MicroTrak
	Performance	Service and support	AceCAD D9000
		Usability	AceCAD D9000

PC Computing BEST

POINTING DEVICE

Kraft Systems' MicroTrak points to success.

Kraft Systems' MicroTrak portable trackball earned high marks for response and accuracy, but its best scores were for usability. Users found it would do what they wanted it to do without trouble or surprises. Also helping the MicroTrak to earn the top spot were its high quality and reasonable price—and the fact that it was among the easiest of the devices to install, a process made simpler by its high-quality documentation.



MicroTrak • Kraft Systems • 450 W. California Ave., Vista, CA 92083 • (619) 724-7146 • $79

POINTING DEVICES

Rank	Product	Type of device Pros and Cons	Performance 40% *	Usability 20%	Documentation 10%	Ease of installation 10%	Price 10%	Service and support 10%	Total Score
1 PC/Computing BEST	**MicroTrak** Kraft Systems 450 W. California Ave. Vista, CA 92083 (619) 724-7146 $79	**Type:** Portable trackball. **Pros:** Excellent performance and usability; can switch for right- and left-handed use; easy, quick installation. **Cons:** Cable too short.	9.2	9.5	9.1	9.1	9.1	9.0	**92.1**
2	**MicroBall** Kraft Systems 450 W. California Ave. Vista, CA 92083 (619) 724-7146 $39	**Type:** Trackball. **Pros:** Excellent price and performance. **Cons:** Support sometimes hard to reach.	9.0	8.9	8.5	10.0	9.6	9.0	**90.9**
3	**TrackMan Portable** Logitech 6505 Kaiser Dr. Fremont, CA 94555 (800) 231-7717 $119	**Type:** Portable trackball. **Pros:** Great service and support; excellent performance and installation. **Cons:** Mounting hardware could be more versatile.	9.2	8.5	8.8	9.6	8.5	10.0	**90.7**
4	**Pet Mouse** Int'l Microcomputer Software 1938 Fourth St. San Rafael, CA 94901 (800) 833-4674 $44	**Type:** Microsoft-compatible mouse. **Pros:** Excellent performance, usability, and price. **Cons:** Tech support difficult to reach.	9.1	9.1	8.8	8.2	9.6	9.0	**90.2**
5	**TrackMan** Logitech 6505 Kaiser Dr. Fremont, CA 94555 (800) 231-7717 $139	**Type:** Trackball. **Pros:** Great service and support; excellent performance, usability, and installation. **Cons:** Large and heavy.	9.0	9.0	8.8	9.1	8.2	10.0	**90.1**
6	**Pen-Shaped Mouse** Golden Image Technology 2657 Saturn St. Brea, CA 92621 (800) 327-4482 $79	**Type:** Stylus. **Pros:** Best usability score; excellent price and documentation; good performance. **Cons:** Service and support could be better.	8.8	10.0	9.4	8.2	9.1	7.9	**89.8**
7	**System Mouse** Int'l Microcomputer Software 1938 Fourth St. San Rafael, CA 94901 (800) 833-4674 $29	**Type:** Microsoft-compatible mouse. **Pros:** Excellent price, performance, and usability. **Cons:** Tech support difficult to reach.	9.0	9.1	8.8	7.8	9.8	9.0	**89.6**
8	**Toptrak** Kraft Systems 450 W. California Ave. Vista, CA 92083 (619) 724-7146 $99	**Type:** Trackball. **Pros:** Innovative foot-pedal clicker; excellent performance, usability, and support. **Cons:** Support sometimes hard to reach.	9.0	9.0	8.5	9.1	8.8	9.0	**89.4**
9	**MousePen** Appoint 4473 Willow Rd., Suite 110 Pleasonton, CA 94566 (800) 448-1184 $99	**Type:** Stylus. **Pros:** Great service and support; excellent performance and usability. **Cons:** Below-average documentation and ease of installation.	9.0	9.0	8.2	8.2	8.8	10.0	**89.2**
10	**Micromouse** Kraft Systems 450 W. California Ave. Vista, CA 92083 (619) 724-7146 $19	**Type:** Microsoft-compatible mouse. **Pros:** Excellent price, performance, support, and design. **Cons:** Support sometimes hard to reach.	9.0	8.2	8.5	8.7	9.9	9.0	**88.5**
11	**D9000** AceCAD 2600 Garden Rd., Suite 121 Monterey, CA 93940 (800) 676-4223 $279	**Type:** Digitized tablet. **Pros:** Most versatile; highest resolution; offers mouse and stylus features. **Cons:** Large footprint.	9.0	9.0	9.4	9.1	6.3	9.5	**88.3**
12	**Thumbelino** Appoint 4473 Willow Rd., Suite 110 Pleasonton, CA 94566 (800) 448-1184 $99	**Type:** Portable trackball. **Pros:** Unique size and feel; modular; most compact; excellent support, performance, and price. **Cons:** Hard to get used to.	9.0	8.7	8.2	7.8	8.8	10.0	**88.2**

* PERCENTAGES REFLECT THE WEIGHT OF EACH FACTOR IN TOTAL SCORE.

Picture Perfect Scans for Every User

Mustek Inc., a leader in the scanning industry, offers you more than just scanners. As the **only** manufacturer in the industry to carry a complete line of scanners, Mustek offers complete and innovative scanning packages specifically suited to your needs.



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The PrinScan line of scanning packages addresses the need for scanning portability for laptops, notebooks, and between different desktop PC computers, **without** ever having to deal with installing an interface card. Simply plug the external adapter into your parallel port and scan in DOS, Windows, or color.

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Circle 118 on reader service card.

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* All package contents are subject to change.

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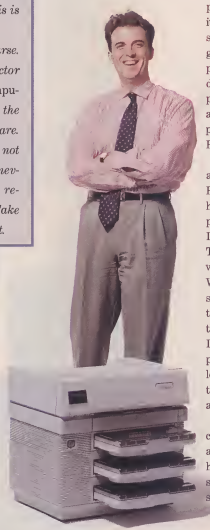
PC/Computing's resident experts pick their favorite products.

EDITORS' CHOICE

What happens when you find the product—not the top-rated product, necessarily, but the one for you, the one you can't imagine being without? The numbers may be against it, and your colleagues may scoff, but for you this is it, the real thing.

You want to tell everyone about it, of course.

Having discovered that the human factor can't be ruled out, we've given PC/Computing*'s editors the chance to shout from the mountaintops about their favorite hardware. The winning products described here did not earn the top spot in their categories, but nevertheless won respect from writers and reviewers who thought they'd seen it all. Take our word for it—that's an accomplishment.*



PHOTOGRAPHS BY JOCK MCDONALD

Compaq Pagemarq

Ask yourself, does your office really print graphics very often? Maybe it's just because I spend my day surrounded by wordsmiths and grammarians, but our networked printers churn out tons of text all day. When we want to see graphics printed right, we sneak over to the art department. Because I need to print text pages fast, Compaq's Pagemarq 20 gets my nod.

The Pagemarq 20 costs $5,898, about the same price as Hewlett Packard's LaserJet 4Si MX, but it has a 20-page-per-minute rated print engine, compared to the LaserJet 4Si MX's 17-ppm engine. The difference in speed is dramatic when you print, say, a 100-page Word for Windows document. In several tests, the Pagemarq printed text 50 to 100 percent faster than the LaserJet 4Si MX. Granted, the LaserJet 4Si MX, with its 600-dot-per-inch resolution, makes graphics look better than the Pagemarq, but the Compaq does a more-than-adequate job.

Like the 4Si, the Pagemarq can connect to your network directly—as a node—saving you the cost and hassle of setting up a dedicated file server. The Pagemarq is fastest and smartest at handling text.

Sebastian Rupley



Turtle Beach MultiSound

Ask any PC audiophile which card's the best that money can buy, and you'll be told that at $599 the MultiSound from Turtle Beach is the Dom Perignon of PC sound boards.

The desktop audio market may just be hitting its stride, but with the MultiSound in my system I won't worry about being left in the dust as sound technology matures. That's because Turtle Beach has been leading the charge for professional PC audio ever since the MultiSound was introduced last year. This high-performance card offered CD-quality recording and playback, wavetable synthesis, and an onboard digital signal processor while everyone else was telling me all that all I'd ever need was 8-bit resolution and FM synthesis.

Like many users I'm still experimenting with PC audio, discovering its potential for business as well as multimedia. But whatever road I take, with the MultiSound I'll be going in style.

Christine Grech

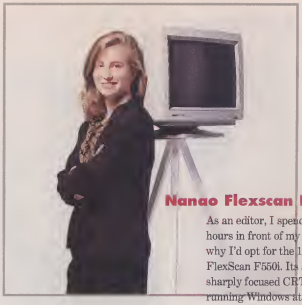
IBM ThinkPad

It weighs more than Zenith's crafty Z-Sport 420S and costs far more than Northgate's stalwart ZXPortable. But the IBM ThinkPad 700C is a marvel of design—less so for individual features than for the way its elements work together. Through and through, the ThinkPad is designed around the way businesspeople actually work.

Ergonomics are paramount: The ThinkPad boasts the largest active-matrix color display on any notebook today and the finest keyboard you'll find on any portable. Period. After all, keyboard and display have more effect on how much work you'll accomplish on the road than do processor speed and drive capacity. Not that the ThinkPad skimps on these. The CPU is upgradable; you can already buy 50MHz versions of the 486SLC chip. And the hard drive is removable; fill one disk, then simply swap it with another. When you find superb ergonomics and exceptional expandability in one graceful package, why look anywhere else?

Marty Jerome





Nanao Flexscan F550i

As an editor, I spend long (and late) hours in front of my monitor. That's why I'd opt for the 17-inch Nanao FlexScan F550i. Its spacious, sharply focused CRT is ideal for running Windows at 1,024 by 768—the resolution of choice for displaying multiple documents simultaneously and for viewing images and fonts at the level of detail at which you would print them.

The FlexScan F550i's sleek touch-sensitive front-panel controls are also the best I've seen. They let me control every imaginable image setting (including color and image alignment), then save the settings in the monitor's microprocessor memory so I don't have to worry about them.

The FlexScan F550i isn't as bright as some other monitors, and its colors aren't as flashy, but that's fine by me—its focus is razor-sharp, which is key when I'm working with text in small point sizes. If I'm going to pull an all-nighter working on a story, this is the monitor I want on my desk.

Wendy Taylor

Insight 486SX-25

Call me a cheapskate, but I can't resist the price of the Insight 486SX-25. For $1,499 you get an expandable, upgradable system with five free slots and a 212MB Western Digital Caviar hard drive. That's just about enough storage to handle my large collection of programs, graphics, and multimedia files. And its price is so low that I'll still have some money left over to make use of those free slots. There's the network card, of course, and a CD-ROM drive, and that sound card I've been needing . . . The Insight can handle it all. In no time I'll have the networked, multimedia PC I've always wanted.

Granted, the Insight's Windows performance wasn't the best in our tests, but it was one of only two 25MHz machines to make the winners' list (the rest are 33MHz systems). And with its OverDrive socket, it'll be easy enough to upgrade the processor and bring the Insight's performance into another class. Even without an upgrade, it's a system with enough power and flexibility to satisfy a CEO—at a price that an assistant editor can afford.

Dylan Tweney



Dell System 466/M

So what if it doesn't include VL-Bus graphics or some hot new caching hard disk controller? I'd take Dell's high-end desktop over the others any day.

Even without all the hotshot hardware, the Dell System 466/M is outrageously fast at running Windows applications. That's because this 66MHz DX2 system offers incredibly fast CPU and memory architecture and mind-boggling proprietary local-bus graphics. Plus, it's capable of resolutions of up to 1,280 by 1,024.

Better still, the Dell earned a record score on our 32-bit software test, outperforming the average system by more than 70 percent. As soon as I decide among Windows NT, NextStep 486, and OS/2 2.1, I'm going to run a 32-bit OS, and I refuse to slog around with anything less.

But don't get the impression I'm just a speed junkie. The really impressive thing about the Dell is its fine internal design. Because both the graphics and the IDE for the 122MB Quantum drive are integrated on the motherboard, all six 16-bit slots are free for expansion. You can extend system RAM to 64MB. And the system's roomy internal layout makes upgrading memory and storage a breeze. I hated the mushy, sticky Dell keyboard, but who cares? You can always get another one. Any way you look at it, this system is choice.

Gina Smith

Canon BJC-800

You can keep your boring black-and-white, 300-dot-per-inch laser printers. I want color—bold color, desktop color, affordable color!

Until color desktop laser printing becomes a reality, I'll make do with the Canon BJC-800. You can wax lyrical about thermal transfer's bright colors, but wait till you see the BJC-800's deep, rich blues and gorgeous greens—perfect for printing scanned photos of my teal blue 1993 Geo Prizm.

Text print quality is damn impressive, too. As with any ink jet, text is more gray than black, but the edges are crisp, even down to the serifs. Graded backgrounds for full-color presentations have very fine dithering patterns. And the 360-dpi resolution means you can see details like the baby hair on my nephew Scott's head.

The BJC-800 isn't the fastest color printer we've ever seen—at less than one page per minute it's more like the tortoise than the hare. The kicker is that Canon just dropped the list price from $2,796 to $1,999. So until I get a better offer (and as fast as printers are changing, that could be tomorrow), I'll just keep printing scanned photos on my Canon BJC-800.

Cyndy Bates





RasterOps/20T

A bargain, that's what I love. High quality at a reasonable price. Not the *highest* quality, mind you, but pretty darn close, and so affordable that I walk away from the purchase feeling like I've gotten away with something.

That's why my choice is the $2,499 RasterOps 20T MultiScan color display. I need its 20-inch size to display two full pages of information onscreen—I couldn't write *PC/Computing*'s table of contents without it. And with highly saturated colors and text that's sharp and crisp even in small point sizes, the RasterOps delivers the image quality I need. Why should I pay more for *ultimate* saturation (from an NEC or a Nanao) when my eyes can't tell the difference between *ultimate* and *excellent?* The RasterOps' whites are uniformly white, dark colors are distinguishable, reds are red (not orange), and, most important, characters are well formed and clear. It supports resolutions of up to 1,280 by 1,024 pixels, but I prefer to use it at 1,152 by 870 (the ideal resolution for two pages of text side by side in Wysiwyg mode). Another bonus is that I can easily use it with either a PC or a Mac, which saves me desk space as well as money. *That's* a bargain.

Charlotte Ziems



Intel SatisFaxtion

As I trawl online services for interesting shareware, the last thing I want to do is decide if I have enough time to download that new Windows app, even if it is almost a megabyte in size. For that reason a 14,400-bps modem is essential—and the Intel SatisFaxtion Modem/400 is the one for me.

The SatisFaxtion is fast—that much is true of any 14,400-bps model—but it's also smart. It buffers data until my PC's serial port is ready for it. It figures out whether an incoming call is from another modem or a fax machine. On the few occasions I'm stumped for an answer, I check out the online help—which is stuffed in its own ROM. And as soon as I get around to subscribing to Caller ID, the SatisFaxtion will be ready to handle it.

All this, and I don't have to bother with a fax machine anymore. With a scanner hooked up to one end of my PC and the SatisFaxtion connected to the other, I can abandon shiny rolls of thermal paper forever.

Matthew Lake



New DOS 6 Utilities From Jeff Prosise



Plus Two Great Books!

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Jeff Prosise designs some of the world's best DOS utilities, according to legions of *PC Magazine* and *PC/Computing* readers. Most think he's a darn good writer, too.

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Now, in two exciting disk/book combos, Prosise offers you these utilities to supercharge your system and heighten your productivity. The utilities were written by Prosise exclusively for his readers and are included in the price of the book. In the text, Prosise shares the wisdom behind the utilities and presents rarely seen performance tips in his distinctively straightforward, hands-on writing style.

PC Magazine DOS 6 Memory Management with Utilities: Jeff Prosise reveals hidden memory areas and memory-saving DOS techniques—many of them previously undocumented—and guides you as you put them to work.

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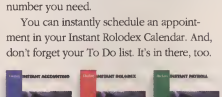
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DOS

Safeguard Files With DOS 6.0's Delete Protection

DOS 6.0 OFFERS THREE WAYS TO PROTECT YOUR FILES FROM ACCIDENTAL DELETIONS. HERE'S HOW TO CHOOSE THE ONE THAT'S BEST FOR YOU. **BY JEFF PROSISE**

SOONER OR LATER, you're going to need a file you've already deleted. With DOS 6.0, there's no need to worry—it has three levels of delete protection. The new Delete Sentry provides the highest level of protection, enabling almost any file to be recovered. Delete Tracker (the updated MIRROR utility) provides an intermediate level of protection, and standard UNDELETE works just as it did in DOS 5.0.

You use all three levels the same way: As soon as possible after deleting a file, you enter

```
UNDELETE filename
```

at a command line. However, the three levels all work differently behind the scenes. Here's how to distinguish them, how to determine which one to use, and how to use it effectively.

Basic Protection: UNDELETE

When you delete a file, DOS locates the file's directory entry on disk, overwrites the first character in the filename with a special character that marks the file as deleted, and zeros out the file's file allocation table (FAT) entries. Because the disk space that the file occupied is no longer reserved in the FAT, future files will overwrite it. Yet, the file contents remain on the disk for now.

When called upon to undelete a file, UNDELETE uses the information stored in the directory entry to reconstruct the file's FAT entries. For each file to be recovered, the utility asks you for the first letter of the filename and restores the file when you type it.

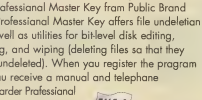
Standard UNDELETE works fine as long as the file's clusters aren't overwritten by another file. If that happens, UNDELETE can't help. Therefore, the sooner you run UNDELETE after deleting a file, the greater the chance that the utility will be able to restore it.

Standard UNDELETE has another weakness: It can restore only those files whose contents have been stored in contiguous clusters. So if your disk is badly fragmented, UNDELETE's chances of success will be much slimmer.

/// DOS Helper ///

Professional Master Key

If you haven't upgraded to DOS 6.0, try the shareware program Professional Master Key from Public Brand Software. Professional Master Key offers file undeletion utilities as well as utilities for bit-level disk editing, unformatting, and wiping (deleting files so that they cannot be undeleted). When you register the program for $25, you receive a manual and telephone support. To order Professional Master Key, call (800) 426-3475 or (317) 856-4144.



Safer Still: Delete Tracker

If the thought of losing a file just because it's not stored in contiguous clusters worries you, use Delete Tracker. This TSR continuously monitors the system for file deletions. When a file is deleted, Delete Tracker copies the file's FAT entries (along with the first character in the filename) to a hidden file somewhere else on the disk. UNDELETE uses this file to reconstruct the filename and allocation chain. Although it is safer than plain UNDELETE, Delete Tracker is powerless to restore a file if it has been partially overwritten by another file.

To enable delete tracking for drives C:, D:, and E:, add this command to AUTOEXEC.BAT:

```
UNDELETE /TC /TD /TE
```

Delete Tracker requires about 9K of memory and only a little disk space.

Super Sentry: Delete Sentry

If neither option seems safe enough, use Delete Sentry to keep other files from reclaiming the disk space used by a deleted file.

Delete Sentry creates a hidden subdirectory called SENTRY and moves "deleted" files there. When you invoke UNDELETE, Delete Sentry moves the file back to its original directory. To activate Delete Sentry for drives C:, D:, and E:, add this command to your AUTOEXEC.BAT file:

```
UNDELETE /SC /SD /SE
```

Delete Sentry requires about 13K of memory and can take up a significant amount of your disk space. To limit the amount of disk space it uses, switch to your DOS directory and type EDIT UNDELETE.INI. In the [configuration] section, change the percentage= line to reflect the maximum percentage of your hard disk that you want the SENTRY di-

rectory to occupy. For example, to limit the SENTRY directory to 5 percent of your hard disk space, change this line to percentage=5. Then save the modified file and exit EDIT.

Note that even while Delete Sentry is active, it's important to undelete a file as soon as possible after deleting it. As the SENTRY directory fills up, Delete Sentry will purge old files to make room for new ones. If the deleted files are large, the SENTRY directory may not be able to hold many.

By default, Delete Sentry does not save files whose archive attributes are set to On. If you're unaware of this "feature," you may be in for a nasty surprise when you delete a file and then discover that you can't undelete it. To configure Delete Sentry to ignore the archive attribute, edit UNDELETE.INI. Look for the line that says archive=FALSE, and change it to read archive=TRUE.

Make the Most of UNDELETE

Which level of delete protection is best suited to your needs? If you want maximum security and you don't mind the disk and memory space that it takes, use Delete Sentry. Delete Tracker consumes fewer resources, and it provides ironclad protection as long as you remember to run UNDELETE immediately after deleting a file.

Use standard UNDELETE only if you want to maximize your memory and disk space. No matter what form of delete protection you use, your chances of recovering a deleted file diminish with time. Always run UNDELETE as soon as possible after deleting a file.

To undelete all the deleted files in a directory, simply type UNDELETE. If you're using standard UNDELETE, type UNDELETE /ALL. Rather than prompt you for the first character in each filename, DOS substitutes a pound sign (#). Use the REN command to restore the files' original names later.

To find out what form of delete protection is enabled and which drives are protected, type UNDELETE /STATUS. If the response is "UNDELETE not loaded," then standard UNDELETE is the current method.

/// Hot Tips

Protect Your Configuration

In DOS 6.0, anyone can skip over CONFIG.SYS and AUTOEXEC.BAT by pressing F5, F8, or Shift during booting—a problem if you load password programs. To remove this capability, open CONFIG.SYS and make this the first line of the file:

```
SWITCHES =/N
```

Save the file and reboot. As an added precaution, add the read-only attribute to CONFIG.SYS with this command.

```
ATTRIB CONFIG.SYS +R
```

To restore the bypass capability, substitute -R for +R to restore the read/write attribute, then remove the SWITCHES line from CONFIG.SYS.

RONNY RICHARDSON

Check Your Disk On Boot-Up

You know the advantage of running CHKDSK each time you boot your PC. But you can also call this batch file from AUTOEXEC.BAT to fix your disk errors automatically and to prompt you when you need to run a disk optimizer. Enter these lines in an ASCII text editor and save the file as DISKCHK.BAT:

```
@ECHO OFF
CHKDSK C:\DOCS\*.* > ERRCHK.TST
TYPE ERRCHK.TST | FIND "lost" > ERRCHK.CHK
TYPE ERRCHK.TST | FIND "errors found" >> ERRCHK.CHK
TYPE ERRCHK.TST | FIND "non-contiguous" >> ERRCHK.OPT
COPY ERRCHK.CHK ERRCHK.ERR >NUL
COPY ERRCHK.OPT ERRCHK.FRG >NUL
IF EXIST ERRCHK.FRG GOTO OPTIMIZE
IF NOT EXIST ERRCHK.ERR GOTO CLEAN
:OPTIMIZE
ECHO Your disk contains fragmented files.
ECHO Run a disk optimizer to correct the problem.
PAUSE
GOTO END
ECHO Y | CHKDSK /F
CLS
Echo CHKDSK /F was run.
Echo Lost allocation units converted to *.CHK files.
PAUSE
GOTO END
:CLEAN
Echo No errors reported.
:END
DEL ERRCHK.* >NUL
```

CHKDSK only searches for noncontiguous files one directory at a time, so change the path in line 2 (starting with CHKDSK) to point to the directory you use most.

Next, add a CALL DISKCHK.BAT statement in AUTOEXEC.BAT before any lines that load programs. The file will run every time you reboot and will notify you if there is a problem. If it finds errors, enter CHKDSK /F at a DOS prompt to correct them.

JOHN TASCHEK

Moving Windows Apps Is Hard to Do

. . . BUT NOT IMPOSSIBLE. HERE'S HOW TO RELOCATE WITH CONFIDENCE. **BY CRAIG STINSON**

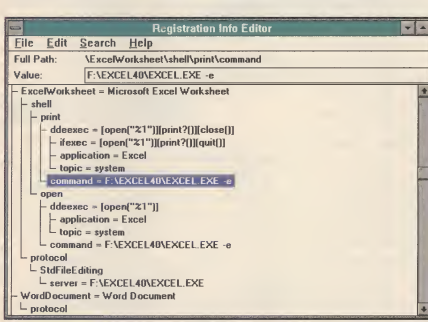
NOT EVERYTHING IS easier under Windows. Hard disk management, for one thing, was decidedly simpler in the old days. Under DOS, changing your directory structure or relocating an application required mastery of just three commands—DIR, COPY, and ERASE. In fact, with a shell program you could do the whole job in minutes by tagging filenames and pressing function keys. Try moving a Windows app sometime, and you'll see how far—and in what direction—Windows has progressed.

If you've bought an extra, faster hard drive or you have a lot of storage space on a network drive, it makes sense to keep Windows programs there, rather than on your cramped old hard drive. However, it's hard to move them because Windows may keep as many as a half dozen separate records of where programs reside. To make most relocated programs work correctly, you must find and modify each record of the program's whereabouts.

If you have a choice, move DOS programs rather than Windows apps. Moving a DOS application that you run under Windows will probably still require you to do more than copy and delete files. But because DOS programs don't create INI files (or entries in WIN.INI) and don't support object linking and embedding, they're easier to relocate than Windows programs.

Nine Steps to a New Directory

If you must move a Windows application, first see if the program offers an uninstall routine. If it does, uninstall the application and then reinstall it in the new directory using your distribution disks. Unfortunately, very few Windows programs provide uninstall services, so you'll probably need to do the job yourself. Here are the steps to follow:



When moving (or removing) Windows applications, most people forget to update the Registration Database. Enter REGEDIT /V from a Run menu, then scan for your application.

Winapp of the Month



ALLINI

When you're editing INI files for program relocation or any other purpose, Notepad's and Sysedit's scroll bars quickly become tiresome. Instead of scrabbling around to find and edit a section, use Wards Plus Connectivity's ALLINI. This INI editor provides section headings in a list and one-step line deletion and editing—and it's freeware. Download ALLINI.ZIP from PC/Contact's data library 3 (Utilities/Misc.), or see page 322 for details about disks from Public Brand Software.

PC/Contact

1. Back up your files. Archive your program's current directory, any subdirectories, and your Windows directory. This will enable you to reverse your steps should anything go wrong.

2. Keep a log. In a Notepad file or on a sheet of paper, jot down everything you do from here to the end of the procedure (for example, "in WIN.INI [Extensions], changed 'xls=C:\EXCEL40\EXCEL.EXE ^.xls' to 'xls=F:\EXCEL40\EXCEL.EXE ^.xls' "). This will keep track of what you have and haven't done, as well as provide you with an alternative retreat path.

3. Move the files. Using a file manager, move all files from your program's current directory to the new location. Also move everything in related directories, because many programs keep their baggage in subdirectories. Be sure to relocate the whole works, not just the executable files. (Data files you've created yourself can stay where they are.)

4. Amend WIN.INI. Open WIN.INI in the System Configuration Editor (Sysedit) or in this month's Winapp ALLINI. Search for references to the directories you've just moved, and edit them so they point to the new directories. You'll most likely need to edit [Extensions], [embedding], and sections created by the application itself.

5. Update other INI files. In a file manager, scan your Windows directory for INI files created by your application. Edit the files as you edited WIN.INI to make all directory references point to the application's new home.

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6. Update REG.DAT. With Program Manager's Run command, run REGEDIT /V. This brings up a complete list of the Windows registration database. With the cursor keys, scroll through the file for references to your program's old directories. Make any changes on the Value line, and save the edited file. (Alas, you can't use Regedit's Search command to hunt for directory references, because it lets you look for text only to the left of the equal sign. Directory references appear to the right of the equal sign.)

7. Update icon properties. If you use Program Manager to launch your program, edit the properties for each icon you use so that the Command Line and Working Directory fields point to the appropriate directories. (Press Alt and double-click on the icon in Program Manager to bring up the Program Item Properties dialog box quickly.)

8. Update your path. If the PATH statement in your AUTOEXEC.BAT file includes a reference to your program's old directory, modify it to point to the new directory.

9. Give it a trial run. Quit Windows, reboot your computer (if you have modified the PATH statement), restart Windows, and try running your program. Then try to run an associated file from File Manager. If all goes well, give yourself a hearty pat on the back.

Prevention is Better . . .

Moving programs is a hassle, so the best policy is to think carefully before you install them. Choose the directory where you'll most likely be able to leave the program for all of its useful life.

Don't put more than one program in a directory, and don't put any program in your Windows subdirectory. Even an innocuous little shareware utility probably comes with an EXE file, a documentation file, a help file, a readme file, and a dynamic link library or two. With all the stuff you already have in C:\WINDOWS, you may never be able to move or delete all traces of an outgrown utility because you won't know what files belong to it. This practice accrues several other benefits. By limiting the executable files in your Windows directory, you add speed to command-line execution of programs in directories further down the system PATH and also make your Windows directory easier to navigate.

Hot Tips

Stop and Start DOS Screens

Tired of using Ctrl-S or Ctrl-P to pause rapidly scrolling screens (such as directory listings) in a DOS window? The same trick that lets you quickly copy text from a DOS window can also freeze scrolling text. First, open SYSTEM.INI in Sysedit or another text editor, scroll to the [NonWindowsApp] section, and look for the MouseInDosBox= line. (If this line doesn't exist, add it.) Set MouseInDosBox= equal to 0 and save your changes. Then exit and restart Windows.

Open a DOS window, start a DIR listing, and click the left mouse button anywhere on the screen to freeze it. Windows stops the directory listing and adds the word Select to the DOS window's title bor. Click the right mouse button to unfreeze the DOS window. To copy part of the DOS window to the Clipboard, use the left mouse button to select the area you want, and press Enter.

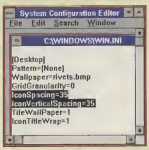
DYLAN TWENEY

Make a Program Manager Utility Toolbox

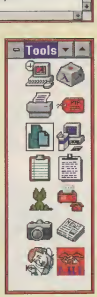
Make a Program Manager tool palette for frequently used Windows utilities so that they're easily accessible but don't take up valuable desktop space.

First, create a new group in Program Manager: Choose File, New, select Program Group, and click on OK. Name the group Tools, type TOOLS.GRP in the Group File: box, and click on OK. Then put the utilities you use most often into this group. To move them, click on their icons and drag them into the new group or copy them by holding down Ctrl as you drag them.

Next, remove the icon titles in the Tools group. To remove an icon's title, hold down Alt and double-click on its icon. In the Program Item Properties dialog box, press the space bar to replace the title with a space, and click on OK.



After you remove all the icon titles, choose File, Run, type SYSEDIT, and click on OK. Select the window containing WIN.INI. In the [Desktop] section, find the IconSpacing= line and set it to 35. Edit the IconVerticalSpacing= line (or add it if it doesn't exist) so that it reads IconVerticalSpacing=35. Save your changes, exit Sysedit, and quit and restart Windows. Adjust the size and position of the Tools group until it's where you wont your tool palette; then choose Window, Arrange Icons to stack its icans together. Press Shift-Alt-F4 to save your desktop.



Finally, open File Monager and select TOOLS.GRP (in your Windows subdirectory). Press Alt-Enter to open the file's properties, put an *X* in the Reod-Only box in order to prevent any changes to your tool palette, and click on OK. Then select WIN.SYD (the backup af WIN.INI made by Sysedit). Press F7, type WIN.INI, and click on OK to restore your old icon-spacing settings. Then exit and restart Windows.

You'll be able to move and arrange your Program Manager desktop normally, with the exception of the Tools group. To change the Tools group, you must first select TOOLS.GRP in File Manager and remove its read-only attribute. After you've made changes to it, set the read-only attribute again to prevent any unwanted changes.

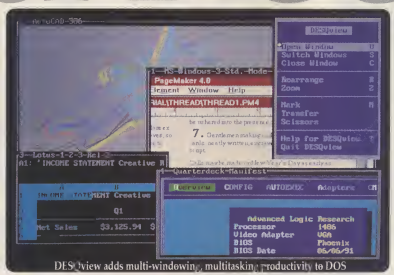
DYLAN TWENEY

The death of DOS
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DESQview adds multi-windowing, multitasking, productivity to DOS

As you may know, DESQview 386 has been around for years, evolving into a highly efficient multitasking, windowing environment that extends the power of DOS, giving you increased productivity while conserving precious memory and disk space. In fact, the vast majority of 386 and 486 PCs need no additional memory or disk space to run DESQview.

DESQview 386 gives you pre-emptive multitasking like OS/2, but with ½th of the disk space and ¼th of the memory requirements. It gives you windowing like MS Windows, but with greater speed and efficiency and fewer 'crashes.' And DESQview lets you use a mouse or stick to the keyboard.

You Create the Standards; We Follow.

We've never been confused about our role. We believe software companies exist to make your job easier and your working day more productive. When publishers step out of that mold and begin to tell you what hardware you need and that you should throw out somebody else's perfectly good software—well, they simply are not operating in your best interest.

Software publishers don't create standards. You do. And whatever standard you choose, we support it.

If you like a program that only runs in MS Windows, like Wordperfect for Windows, DESQview 386 supports your choice. If you prefer a spreadsheet that runs in DOS, Lotus 1-2-3 Release 3, for example, we support that too. In fact, DESQview 386 lets you run your favorite DOS and Windows programs side-by-side.

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DESQview 386 comes with QEMM-386, the number one memory management utility, and Quarterdeck Manifest, the award-winning memory analysis and monitoring program. Between them, they assure you every last 'K' of memory is put to use*. In many cases, QEMM can mean the difference between running the TSRs you want and not having enough memory.

And DESQview is an open doorway to the future, too. Our next step up, DESQview/X, opens your PC to a network full of possibilities, including graphic workstation standards—X Window System software—all while retaining the compatibility of DESQview.

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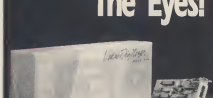
*DESQview makes multitasking and windowing available to users of 286-class machines with similar memory efficiencies through QEMM-50/60 for IBM™ PS/@ 50 and 60 users and QRAM for other 286 users.

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This Month's Free Software and Shareware All the public-domain and shareware programs, batch files, and utilities featured in *PC/Computing* each month are available on our online service, PC/Contact, or on disk from Public Brand Software for a fee. Shareware requires additional payment to authors for continued use. Here's a sampling of the programs you'll find this month.

APMCHK ..... **Q&A, page 354**

Uncertain whether your laptop supports Microsoft's Advanced Power Management feature? If it does, you can take advantage of DOS 6.0's POWER.EXE to reduce memory usage by as much as 25 percent. Our utility tells you if your BIOS supports APM and returns exit codes you can incorporate into batch files that contain IF ERRORLEVEL commands. You'll find APMCHK.ZIP in data library 1 (Hot Tips/Secrets).

ALLINI ..... **Windows, page 318**

Spend several sessions editing INI files, and you'll be ready to ditch Notepad, Sysedit, and even Norton's Desktop Editor. To edit an INI file, you're best served by a dedicated INI editor—and they don't come much better than ALLINI from Words Plus Connectivity. This freeware app provides a list of your file's section headings, search capabilities, and one-step editing of lines. Unlike Windows' Sysedit, it's not limited to WIN.INI and SYSTEM.INI. Download ALLINI from data library 3 (Utilities/Misc.).

The *PC/Computing* Hardware Buyer's Superguide: A Roundtable Any questions or comments about the companies and products featured in this year's 200-strong hardware roundup? Join us in a roundtable on ZiffNet's Executives Online. Between June 1 and June 4, Editor Ed Bott and other editors from *PC/Computing* will join product managers from some of the winning companies to field questions about the tests and weightings in the hardware evaluation. ZiffNet members can join the conference by typing GO ZNT:EXEC at any CIS prompt.

HOW TO JOIN PC/CONTACT

For current CompuServe subscribers, just type GO PCCONTACT to access the forum. Cost is based on CIS's fee of $12.80 per hour for 1,200/2,400 bps and $22.80 per hour for 9,600 bps. There is an additional $2.50 ZiffNet membership charge per month for all users, which includes a number of free services. For complete information, type GO ZNT:RATES when online.

For new subscribers, follow these steps:

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2. Call CompuServe's toll-free Customer Assistance Line at (800) 848-8990 (United States) or (800) 635-6225 (Canada); this call is quick and free. From other countries, dial CompuServe direct at (614) 457-8650. A voice-response system will ask you if you want a local-access number. Then you'll be asked to enter your phone number and the speed at which you want to access the system. CompuServe reads back the local number you'll use to access the service. The call is quick and free.
   Or, call CompuServe with your modem. Set up your modem and telecommunications package using 7 data bits, even parity, 1 stop bit, and full duplex, and call (800) 346-3247. When the modem connects, press Enter. When you see the HOST NAME prompt, type in PHONES and then hit Enter. Then just follow the onscreen menus and note the access phone number for your area.
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4. At the HOST NAME prompt, type CIS (which is the acronym of the CompuServe Information Service).
5. At the USER ID prompt, enter 177000,5300.
6. At the PASSWORD prompt, enter PC/CONTACT.
7. At the ENTER AGREEMENT NUMBER prompt, type ZIOCPCC1.
8. If you have trouble, call the Customer Assistance Line at (800) 848-8990. After you follow the above procedures, the CIS system will provide you with your own user ID—called a PPN—and a temporary password. You can then log on and begin to explore PC/Contact. In about two weeks, you'll receive a letter from CIS confirming your PPN and providing you with a new password. You should then change your password by typing GO PASSWORD at any CIS prompt.

TOP PICKS ON DISK

You can easily get all the public-domain utilities or shareware covered in this month's issue by calling the disk vendor Public Brand Software at (800) 426-3475 or (317) 856-7571. Ask for this month's Editors' Picks from *PC/Computing*. They're available for $5 or less per disk (most disks have several utilities and programs on them), plus $5 for shipping and handling. Visa and MasterCard are accepted.



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PARADOX

FAST MATH IN A FORM

Occasionally you'll want to perform a quick calculation on two fields in your database form and update the answers in your table. Unfortunately, calculated fields in Paradox are read-only. Here's a quick patch that uses SETKEY to assign the Ctrl-C combination to multiply two fields in a form and post the answer in a table.

Assuming your table contains fields for QUANTITY and PRICE, select Modify, Restructure, and add a numeric field called TOTAL. If yours is not the default Paradox form, select Form, Change, type in your table name, select the form you're using, and add the new field. Press F2 to update your modifications, then select Tools, Editor, and open INIT.SC—found in the same directory as the Paradox program files—and add this line:

```
SETKEY 3
 [Total]=[Quantity]*[Price]
```

Restart Paradox, and open your form in edit mode. Fill in values for Quantity and Price, and then press Ctrl-C to post the value in the TOTAL field.

JOHN TASCHEK
ASSISTANT EDITOR

FILEMAKER PRO

INSTANT ENTRY RECALL

Entering randomly repeating data in a FileMaker Pro field can be annoying—you have to rekey the data for each record and avoid typing mistakes at the same time. To simplify data entry while maintaining accuracy, you should create a macro that recalls all your entries with a click of a button and lets you paste your choice directly into a field.

Open your FileMaker Pro database, and choose Select, Layout. Select the box item from the toolbar, and position it on your form. Then select the text item, position the text insertion cursor on the box, and type RECALL. Click outside the text you just typed, and then drag it on to the box. Click again on the text item to select it, choose Scripts, Define Button. Scroll down the list of available choices, and select Paste from Index. Check Select Entire Contents to make FileMaker show the entries depending on the active field. Choose Select, Browse, and click on the new button for a list of all entries for that field. Double-click on an item to paste it into the field.

If you would use this function infrequently and don't want to make the button, you can simply use Paste from Index while in Find mode. Choose Select, Find, and select Edit, Paste Special, From Index. A dialog box showing the entries in that field will pop up.

LISA TUTTEROW
EL TORO, CALIFORNIA

Step by Step: Excel 4.0

MAKE YOUR MACRO BUTTONS GRAPHICAL

Place easy-to-select buttons in your worksheets to run your macros. First, open your worksheet and one of your macro sheets. Right-click on the Standard toolbar, select Utility, and proceed.

STEP 1. Create a macro button.
Select the Button tool, then drag the mouse to draw a macro button. In the Assign To Object dialog box, select or type a macro name, and press Enter. Replace the button's title with a meaningful label. Right-click on the button, select Text, and under Vertical Alignment, select Bottom. Click on OK, then press Esc to deselect the button.

STEP 2. Incorporate a graphic.
Open a graphics program—or switch to the Character Map to access symbol fonts. Select an appropriate symbol for your button, then copy it to the Clipboard. Return to Excel, and press Ctrl-V to paste the character into a cell. If the cell doesn't display the correct font, right-click on the cell, select Font, and choose the correct font in a large point size.

STEP 3. Place the graphic.
To place the graphic on the button, select the graphic's cell, hold down Shift, and select Edit, Copy Picture. Select As Shown when Printed, and click on OK. Then press Shift and select Edit, Paste Picture. Drag the image into place on the button, and resize it to fit.

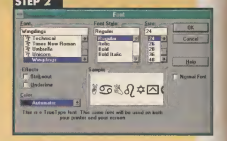
STEP 4. Combine the elements.
To make the button a uniform gray, right-click on the graphic, select Pattern, and change the Border to None and the foreground color to gray. Click on OK. Finally, group the graphic and button into a single object: Press Shift and click on the button, then right-click and select Group.

CHRISTINE RIVERA
NEW YORK, NEW YORK

STEP 1



STEP 2



STEP 3



STEP 4



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LOW MEMORY ACCESS

Is performance slow when you run Access on systems with 4MB of RAM or less? Access benefits more from having direct use of memory than from having memory dedicated to disk caching or buffering. The following steps free up memory and boost performance.

If you run a RAM drive, remove it while you run Access. Then reduce SmartDrive's WinCacheSize to 256K to allocate more RAM to Windows. First, open AUTOEXEC.BAT in a text editor and then replace the current SmartDrive line with this line:

```
C:\WINDOWS\SMARTDRV 1024 256
```

Note: The default WinCacheSize configuration on a 4MB machine is 512K.

Next, if you don't require the various Wizards, remove them to save 300K of memory. Open MSACCESS.INI in a text editor, page down to the [Libraries] section, and then insert a semicolon before the wizard.mda= line:

```
;wizard.mda=ro
```

While you're in MSACCESS.INI, add the following statement to the [ISAM] section of the file to limit the I/O buffer size. If the statement already exists, change the value to no more than 512:

```
MaxBufferSize = 512
```

Finally, to free up an additional 300K or more of memory, remove any background wallpaper, sound or multimedia drivers, and screen savers from your set up—you should notice a dramatic increase in performance speed.

MITCHELL YOUNG
SEATTLE, WASHINGTON

MICROSOFT EXCEL 4.0

STARTUP TO THE MAX

Tired of maximizing Excel every time you open the program? Create this simple macro to make Excel start in a maximized window every time. Select File, New, Macro Sheet, and click on OK to open a blank sheet. In cell A1, select Formula, Define Name, type in AUTO_OPEN, and then click on OK. Move down to cell A2 and type

```
=APP.MAXIMIZE()
=RETURN
=FILE.CLOSE()
```

Save your macro under any name in the XLSTART directory. *Note:* If you're using a global macro sheet, follow this procedure in the file GLOBAL.XLM.

ANSON WALKER
EL PASO, TEXAS

LOTUS 1-2-3

PRINT TO FIT IN 1-2-3

If your 1-2-3 3.1 worksheets won't print on a page, use Wysiwyg to scale them down. Block off the range you

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There are at least 100 reasons to consider OS/2®. They range from the substantial (the ability to solve complex problems with information that originates from multiple sources) to the sublime (it looks cool and is fun to use). In between, this enterprise-strength operating system brings both large and small benefits to anyone who uses a PC: OS/2 guides you into new computing territories instead of confining you within the boundaries of older technology.

On the following pages, we list 100 of the most exciting aspects of OS/2 today. This is just the beginning.

OS/2 HAS ARRIVED

1 OS/2 IS HERE, NOW

The greatest advantage OS/2 has over its perceived competition is the fact that it is available now. Today. Anyone who wants to gain 32-bit personal computing power can buy a copy of OS/2 and install it on their machine. There is no waiting. There are no lines. There are no promises about something that will arrive in a month, six months or a year. It's here. For real.

2 ONE OS/2 SIZE FITS ALL

People—from the most naive beginner to the busiest expert—need a variety of computers. As these needs converge, people may try to engage two or more machines to complete all their computing tasks. To add to the confusion, some vendors sell (or will sell) one operating system for the end user and another for networks and power users.

OS/2 offers a system that is intended to reach across these boundaries and provide enterprise-strength functionality. It supplies beginners with ease-of-use and brings hardcore power to the most technical users. And while there are minimum hardware requirements for OS/2, they do not exceed those for the majority of the PCs sold today. So OS/2, in its standard configuration, is suited for everyone: From the person with a 16 MHz 386 SX to the MIS director of a large bank. As user's needs evolve, IBM will offer specific versions of OS/2 for different platforms—all running across the computing enterprise while using a common operating environment.

3 OS/2 IS FLEXIBLE

Anyone who uses a PC today deals in multiples. Central information originates from several diverse sources. It is likely you work with a variety of applications at work, at home, on the road and on the network. As a result, you can't settle for anything less than flexibility and portability.

OS/2 performs well in any of the three primary computing environments: desktop, mobile and network. Whether on one desktop or connecting to many, data transfer is easy, and you only need to learn one computing style—or language—to deal with all the information that you face during any computing day.

4 OS/2 PROTECTS YOUR PERSONAL COMPUTING INVESTMENT

The first step in designing a computing environment is to determine the task that needs to be accomplished and then select the software that completes the task. The next step is to procure the machines—and the operating system—on which the applications will operate.

These choices, however, are always a lot harder than they sound. Nobody uses just one program to perform a single task. Instead, they are using several different packages to accomplish disparate functions. Some software may be obsolete but is not replaced because of a personal, personnel or financial investment. Or it's not replaced because it still does the job. In either case you can benefit from OS/2, as it supports the most important past and present application software programs and will continue to do so in the future.

5 OS/2 IS EASY TO LEARN, USE AND ADOPT

OS/2 protects your existing software investment by bringing older products under a new umbrella. It is easy to learn and use, with little training (or retraining) required. So if you have a large team using WordPerfect* on 386-25 PCs, adding OS/2 increases power but doesn't change your workstyle.

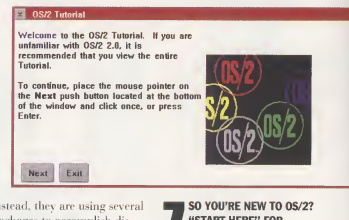
OS/2 is the best platform for the new and exciting applications that take advantage of the previously uncharted 32-bit landscape. So you can continue to use WordPerfect for DOS under OS/2 and adopt exciting 32-bit applications like Lotus cc:Mail for the OS/2 Workplace Shell.*

6 OS/2 IS EVERYWHERE

After OS/2 was released, there didn't seem to be enough copies to go around. People who heard about OS/2 and wanted to take it on a test drive had trouble getting a copy. This is no longer the case. OS/2 is available through all the most convenient retail and direct channels—essentially everywhere that better software is sold. And if you have trouble finding a copy of OS/2 in your neck of the woods, you can always contact IBM directly, by calling (800) 3IBM-OS2 (342-6672). (In Canada, call (800) 465-7999.)

FIRST THINGS FIRST

The OS/2 Tutorial, accessible from the Information Folder, leads the new user through a step-by-step primer on the most important highlights of OS/2. Browsing through the Tutorial in the beginning can save time later.



7 SO YOU'RE NEW TO OS/2? "START HERE" FOR AN EASY PRIMER

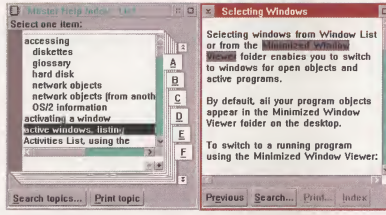
When you first install OS/2, you will notice a Desktop icon—a target with an arrow pointing to its center and labeled "Start Here." Please do. This begins an easy-to-use primer on the most common OS/2 commands and functions. It consists of two windows—topics on the left and information on the right. Double clicking on a topic brings up scrollable information, telling you all you need to get started about that particular aspect of OS/2.

While it is true that OS/2 is generally intuitive, taking fifteen minutes or so to browse through the Online Tutorial—contained in the Information Folder—can build a deeper knowledge of the system and save time later.

8 OS/2 PROVIDES A FAST PATH TO HELP

OS/2 offers continuing education. Just as the tutorial is for beginners, the system's online, context-sensitive help component provides continuing OS/2 education. Access "Help" (a single right click on any object) by selecting it from the pop-up menu of any application, or hitting the universal F1 key. And the Master Help Index—another Desktop object—is an alphabetical, hypertext-driven list of every element of the system.

And the best news is that the breadth and depth of the online system makes those big-dust-gatherers, "Documentation Manuals," obsolete. The thorough, easy-to-access online help system gives you the information you need when it is needed. So you will never be stuck.



HELP AS NEEDED

The Master Help Index—a default OS/2 Desktop object—offers an online, in-depth guide to all of the OS/2 system functions. This alphabetical, hypertext-driven module gives you immediate access to information when it is needed the most.

OS/2 IS A POWERFUL OPERATING SYSTEM

9 32-BIT OPERATION ENHANCES SPEED AND PERFORMANCE

Increased speed is the most visible and tangible improvement of a 32-bit system, so it tends to be the first thing that a new OS/2 user will notice. To just say "it goes faster," however, is to tell only part of the story. 32-bit operation provides a wider data path and more efficient memory usage, which changes the way the computer and the software interact.

A 32-bit data path relieves the existing 16-bit memory bottleneck, increasing the overall data transfer rate. This meets the demands of modern processor-intensive applications—at their most demanding on the network server—and provides a clearer path for the manipulation of bitmaps, graphics and numerical data. Developers of 32-bit applications gain access to a large "flat" memory model of up to 512 MB, where they don't need to worry about restrictive segmented architecture that 16-bit programming environments force upon developers. This means you will see more flexible and powerful applications arrive for OS/2 that take advantage of these new capabilities. And these new programs will include unprecedented speed and efficiency.

10 A 16-BIT APPLICATION BENEFITS FROM THE 32-BIT ENVIRONMENT

32-bit programs have special speed and function characteristics. They use memory and resources more efficiently, and they provide a more hospitable development environment since the programmer has fewer memory restrictions. While a 32-bit operating system does not change the structure or the operation of a 16-bit program running under OS/2, the 16-bit program can still benefit from an efficiency boost.

Also, OS/2's inherent Crash Protection prevents a misbehaving 16-bit application from invading the individual memory space of other programs—DOS, Windows* or OS/2—running at the same time.

TIP: INFINITE VIRTUAL

Under OS/2, you can have up to 240 virtual DOS and Windows* sessions. Here, you can tweak individual DOS or Windows sessions with a custom configuration that governs that session and makes any startup changes needed to get the most out of a DOS or Windows program.

11 OS/2'S MULTITASKING LETS YOU RUN SEVERAL POWERFUL PROGRAMS

Today's users want their operating system to allow them to perform multiple, simultaneous activities so they can get the most out of their time at the computer. A fully pre-emptive multitasking environment, OS/2 is able to run several concurrent functions while making foreground applications more responsive to the user. This differs from the cooperative multitasking mode used by Microsoft Windows, which requires applications to relinquish control of the processor. This can be inefficient. When Windows executes a background print command, the foreground spreadsheet recalc can take much longer.

Under OS/2, the recalc and the print job run simultaneously and you can even begin a third, fourth or additional task. And as people want to do more with desktop PCs—exchanging information, running data searches and printing long documents are only the beginning—they need true multitasking power to support them.

12 MULTITASKING CHANGES HOW YOU WORK, BECAUSE YOU NO LONGER HAVE TO WAIT

There are a lot of little jobs that slow down your day: Sending or printing a file. Formatting a disk. Installing software. Copying files from one directory to another. Running a database search. In any of these cases, the tendency is to issue the command and then take a coffee break, read the newspaper or return your phone calls until the job finishes.

OS/2, however, doesn't make you wait. You can stick a disk in drive A and issue the "format" command, then continue working on a document or spreadsheet. Where the tendency was to stare at the cursor for a minute or two as it changed to and from an hourglass, you can now switch tasks. This time can be spent more "productively," on a spreadsheet or a document or—if your system is connected to a second modem—another upload or download. This will change how you perceive the computer, as you are no doubt accustomed to sitting at your desk and waiting for the PC to finish its job.

13 TIP: A HANDY TASK LIST

Unlike Windows, the OS/2 default configuration doesn't show minimized icons directly on the Desktop. But you can find out exactly what applications are running at any time, one of three ways:

• On the Workplace Shell, click both the left and right mouse buttons simultaneously to call up the Window List.

• From within any application hit Ctrl-Esc.

• Select the Minimized Window object on the Workplace Shell, for an iconic view of all open applications.

Then, to switch to any task from the Window List, double click on the application name. In the Minimized Window object you just double click on the preferred icon.

14 MULTITHREADING ALLOWS APPLICATIONS TO WORK BEHIND THE SCENES

Just as a multitasking PC can run several applications concurrently, an application capable of multithreading can execute simultaneous internal functions. Each function—like printing or spell checking on a word processor—uses a separate "thread." This means that you'll be able to work more efficiently with your application, putting many functions to work for you at the same time. So the repagination of a large document won't cause a work slowdown, as each thread performs its task independently.

Multithreading is especially useful in communications packages, where concurrent functions help to speed the data flow. In fact, an OS/2-equipped machine could send material through one serial connection and receive through another, and still allow another task to be completed.

Imagine a spreadsheet that can recalc and revise at the same time, or a database that will simultaneously update and search. This saves time for users. And multithreading is a valuable tool for developers of all types of application programs.

15 TIP: ENDLESS CLIPBOARDS

OS/2 gives each WIN-OS/2 Full Screen and every OS/2 session its own clipboard. Clipboards can be shared, or made "Public" across the entire OS/2 system to share data between WIN-OS/2 (OS/2's implementation of Windows functionality) and OS/2. Only "Private" clipboards can be used in the current session, but making clipboards Private in WIN-OS/2 Full Screen sessions increases the speed of Windows cut-and-paste operations. Use the Options menu for the Clipboard.

16 UNDER OS/2, YOU CAN BOOT INTO DIFFERENT ENVIRONMENTS

With OS/2's dual boot and Boot Manager features, a single PC can operate two or more operating systems, increasing the range and the versatility of the machine. With Dual Boot, you are given the choice of all options at startup. If you don't respond at a predetermined interval, the machine will start the last operating system used.

OS/2 contains DOS and Windows functionality, essentially providing three operating systems in a single box, so Dual Boot won't be necessary for most users. But in special cases—like a developer who may want to use the same machine for everyday work with OS/2 (operating system #1) and a unique development with XENIX(operating system #2)—the Dual Boot feature could eliminate the need to buy a second PC.

17 OS/2 IS THE INTEGRATING PLATFORM

While you can configure an OS/2 machine to boot into any version of DOS or Windows* you can run several versions as OS/2 tasks. For instance, you can run a Windows 2.x application as one task and a Windows 3.0* application as another. Or you could run separate windows that support different versions of DOS. This extends the versatility of the machine even further, allowing you to run almost any version of any PC software program that has ever existed.

An incredible value: this support for OS/2 Windows, and DOS applications is all included in OS/2; you don't have to buy DOS or Windows to get it.

18 TIP: FASTER, FASTEST

If speed is important when running DOS or Windows programs, use the DOS Full Screen or WIN-OS/2 Full Screen choices in the Command Prompts folder rather than their "windowed" siblings. The DOS or Windows applications will run faster if they have the screen real estate all to themselves.

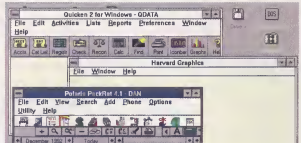
Also, if you have any DOS print spoolers or the Windows Print Manager* installed, disable them. Rely on the built-in, system-wide OS/2 print spooler instead.

19 OS/2 IS BUILT FOR TODAY'S HARDWARE

The evolution of graphical environments has increased the power of the average PC. As a result, OS/2 works on any Intel®-compatible 32-bit processor (386, 486 and above) and will run well on any chip that runs at 16 MHz or higher. As for video, OS/2 looks great on any standard VGA, offering a crispness and clarity that is unmatched by other graphical software, and it takes great advantage of higher-resolution systems.

OS/2 DOES WINDOWS

OS/2 is now the only PC operating system you need to run all of your favorite applications. Now, under the umbrella of the ultra-stable OS/2 environment, you can securely run your favorite Windows applications and utilities.



The OS/2 system, with all options installed, takes up more space than Windows or DOS. Two factors make this less severe than it may sound: The industry-standard PC now comes outfitted with 120 MB hard disks and above. And the full OS/2 installation provides for the complete functionality of DOS and Windows: So 30 MBs actually accommodates three different operating systems, although the OS/2 system can be installed on as little as 15 MB.

20 TIP: THE OS/2 COMMAND PROMPT CROSSES OPERATING SYSTEM BOUNDARIES

The OS/2 Command Prompt, accessible either in a full-screen configuration or in a window, can immediately launch any program regardless of its origin. So you can type a DOS, Windows or OS/2 command, and the system will just load the program. For instance, if you want to launch a word processor like Ami Pro® from the DOS command line, you need to type "WIN AMIPRO." Under OS/2, a simple "AMIPRO" will do.

21 OS/2'S SUCCESS CROSSES BRAND-NAME BOUNDARIES

From IBM Personal Computers to "homegrown" clones, OS/2 is constantly being evaluated for compatibility. This has led IBM to state that OS/2 will work with your Intel 386 SX or higher system—PS/2 not required. OS/2 thrives on any machine with enough juice, be it ISA, EISA or Micro Channel.

EISA and Micro Channel offer great advantages, and both offer performance improvements beyond those available in standard machines. Both are better equipped to handle multiple serial communications devices. And, as they use a separate bus for many tasks, they can be a better environment for multitasking activities.

IBM's hardware compatibility testing checks 18 key functions of OS/2 on a variety of personal computer hardware systems. Compatibility testing extends beyond OS/2 itself and into OS/2 Extended Services, Distributed Database Connection Services/2, OS/2 LAN Server and OS/2 LAN Enabler. To date, over 400 configurations have been verified as compatible with OS/2. Test results on various models are continuously updated and available from IBM OS/2 dealers, as well as through the on-line services CompuServe® and Prodigy®.

22 OS/2 MAKES GOOD USE OF MEMORY

As personal computers continue to take on the tasks formerly in the domain of mainframes and minicomputers, Random Access Memory, or RAM, is another area where more may never be enough. You may need to add memory to your PC to run OS/2 (or even less productive operating systems). A minimum of 4 MBs of RAM is needed for the system to function, while 8 MB is enough memory for OS/2 to provide the industrial-strength support corporate users demand.

There is no practical limit to the amount of RAM that OS/2 can use, as the system is capable of addressing up to 2 gigabytes of virtual memory and more than 16 MB of physical memory. As graphical applications become more popular, the amount of RAM required for spry operation will increase. In a few years, it won't be uncommon to find PCs with 64 MB of RAM—essentially mainframes on the desktop. OS/2 is ready for this challenge.

23 OS/2'S MEMORY MANAGEMENT GIVES THE USER MUSCLE

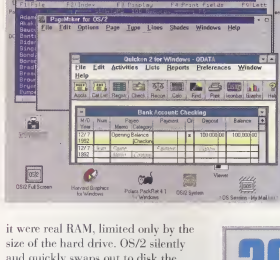
Users accustomed to jumping through memory management hoops will be pleasantly surprised by OS/2, as they can take advantage of built-in DOS memory management. Tuck TSR (Terminate and Stay Resident) programs neatly out of the way by using the LOADHIGH command within DOS. If you really want to push the envelope, OS/2 will give each program up to 48 MBs of combined XMS/EMS memory, and up to 512 MBs for each application written to the DPMI specification.

Additionally, OS/2's virtual memory manager treats hard disk space as if

24 OS/2'S MEMORY MANAGEMENT ELIMINATES THE RAM CRAM

One category of software clearly not needed as a supplement to OS/2 is memory management utilities, as they are already an integral part of OS/2's 32-bit architecture.

OS/2 shatters the 640K barrier permanently with its flat, or linear memory model, giving DOS, Windows and OS/2 programs as much memory as they need without breaking the memory into segments. OS/2 can handle memory objects from 1 byte to 4 gigabytes, giving you flexibility at both the small and large ends of the spectrum. OS/2 recognizes and uses all available memory. And you can set up DOS or Windows sessions individually with extended LIM4 XMS 2.0, expanded LIM EMS 4.0 or DOS Protect Mode Interface (DPMI) memory.



OS/2 DOES EVERYTHING

OS/2's ability to run Windows™ is only the beginning. The system also supports DOS equally well, and can run applications from all three environments at the same time—even on the same screen. So whatever PC software you need, OS/2 will bring it to the forefront.

it were real RAM, limited only by the size of the hard drive. OS/2 silently and quickly swaps out to disk the memory that hasn't been used recently, freeing up real memory for active processes. Because OS/2 manages memory in small 4 KB objects instead of variable 64 KB chunks, memory fragmentation and swapping is reduced, and speed is increased. Rather than getting "Out Of Memory" errors, you get fast, efficient, virtual memory management that makes the best use of your computer resources.

25 CRASH PROTECTION™ IS AN INEXPENSIVE INSURANCE POLICY

Crash Protection is OS/2's way of keeping a single, misbehaved program from converting the entire environment into a gang of delinquents. With Crash Protection, you may have a misbehaved program, but one that's kept in solitary confinement. OS/2 protects system memory from your applications, as well as protecting the applications from each other.

By comparison, when a General Protection Fault (GPF) or a memory violation occurs under standalone Windows, your only recourse may be to reboot. Even if you can continue working by closing the offending program, there is a chance that the violation might come back to haunt you. Under OS/2, each window runs in its own virtual workspace (each workspace is a separate personal computer, as far as memory is concerned). If you get a GPF, only that workspace is affected. All other applications are protected and can continue undisturbed. So a single application failure won't hang the entire system.

26 TIP: WHEN EVERYTHING STOPS, DON'T PANIC

Occasionally, all activity in a window may come to a sudden halt. Don't reboot—yet. Instead, hit CTRL-ESC (for the Window List). Don't move the mouse or hit any other keys. Wait a minute. While the screen isn't doing anything, OS/2 is investigating what caused the application to freeze in the first place. In most cases, the Window List or an error message will pop up. Or, the application will simply un-freeze after OS/2 has completed its diagnostics. At that point you may choose to close the application or keep working.

27 CRASH PROTECTION WORKS ACROSS DIFFERENT ENVIRONMENTS

OS/2's ability to protect one application from the anomalies of another is a productivity breakthrough, but that's only half of the story. Any program running under OS/2—DOS, Windows or native 32-bit—shares this benefit. For instance, if you were running 32-bit DeScribe® 1-2-3 for DOS, and Corel Draw* simultaneously, a memory fault that occurs in any one of these applications won't influence the behavior of the others. Furthermore, you can run different DOS applications in separate windows, and they will maintain the same isolated memory use and function (although it is possible to cut-and-paste information between the different programs).

In this case, OS/2 enhances standard DOS by adding the ability to truly multitask character-based, 16-bit applications. So installing OS/2 offers a clear advantage even if you continue to use the same DOS or Windows programs and postpone the use of 32-bit software.

TIP: OS/2 CAN FIX DISKS

If you actually want to repair your hard disk using CHKDSK, boot your system from a different disk. Use the Installation Diskette that came with OS/2. Insert it in drive A and restart the system. When the IBM logo appears, remove the Installation diskette and insert diskette 1. Press ENTER. When the first text screen appears, press ESC. This dumps you into the OS/2 command line. Insert diskette 2. Now, type "CHKDSK C: /F" to run CHKDSK from the floppy. (If C: isn't your hard disk, replace it with the correct letter in the command).

28 THE HPFS MAKES FILE AND DISK MANAGEMENT MORE FLEXIBLE

The High-Performance File System (HPFS) is OS/2's way of making file management flexible. Its benefits are numerous: longer file names, less disk fragmentation, and access to traditional DOS FAT (File Allocation Table) files.

HPFS files can have long names, up to 254 characters including spaces, commas, periods and other punctuation. That's a long way from the 8.3-character FAT naming convention. Your "BDGT1992.DOC" now can be "Company-Wide 1992 Budget, Revision 1.0." The HPFS resists disk fragmentation, leading to higher performance: It's often five-to-ten times faster than FAT. The HPFS also recognizes and reads information created on disks using the FAT file system.

HPFS isn't for everybody. It is at its best on OS/2 systems with at least 6 MBs RAM and a 60 MB or larger hard disk. And if you increase the capabilities of your system, the HPFS will grow with it, supporting storage devices up to 512 gigabytes. The HPFS is an option when you initially install OS/2, or else you can add it later. If you have a larger disk, HPFS is a better choice for managing it.

29 OS/2 HELPS TO TRIM THE FAT

If you prefer not to use the HPFS, OS/2 has an enhanced FAT (File Allocation Table) file system. Sticking with FAT is a good choice if you want to retain two-way compatibility with an earlier version of the OS/2 operating system or DOS. (The HPFS will easily read DOS FAT files, but HPFS information may not be read by systems using FAT.) Or, if you have less than 6 MBs RAM for OS/2, FAT will perform best.

FAT isn't exactly the FAT you're familiar with under DOS. Under OS/2, both FAT and the HPFS read ahead (for sequential I/O), "lazy write" to disk, and accept threshold parameters. The bottom line to these technical features is a faster FAT. So, even if you choose FAT, you've still got OS/2 power and speed working for you.

30 TIP: THE SKINNY ON HPFS AND FAT

If you have no idea whether your OS/2 system is running from an HPFS (High-Performance File System) or FAT (File Allocation Table) partition, the CHKDSK command has the answer. Open up an OS/2 Full Screen or OS/2 Window session by clicking on the appropriate icon in the Command Prompts folder, inside the OS/2 System object. Type "CHKDSK" at the OS/2 command prompt. The first line will tell you whether you're running on a FAT or HPFS volume. You'll also find out how big the hard disk is, how much space is available, and so on. However, CHKDSK won't accurately report any errors, because it's running on the same disk it's checking.

31 300,000 PEOPLE TESTED OS/2 IN REAL-LIFE WORK ENVIRONMENTS

Prior to its release, OS/2 was tested at 30,000 sites by more than 300,000 users. This became the most comprehensive pre-release software test for any operating system or application in PC history, putting OS/2 through stress, usability and performance gauntlets.

Testing continues as every new release is readied. For example, IBM publicly announced the availability of pre-release copies of new versions of OS/2 on CompuServe. Copies were made available to customers who called a toll-free number until IBM distributed in excess of 10,000 betas in little more than a month. IBM answered beta questions on CompuServe, incorporating valuable customer input into the product.

32 YOU CAN AUTOMATICALLY PROTECT THE OS/2 SYSTEM

Afraid of leaving your computer screen open to prying eyes? Part of OS/2's overall emphasis on security includes the Lockup feature. Lockup is a combination screen blanker, screen saver and password protection device.

To activate Lockup from the Workplace Shell, click the right mouse button and choose "Lockup now." Or determine in advance if you'd like Lockup to automatically start after the computer has been inactive for a set amount of time. Lockup will kick in by showing a bitmapped graphic of your choosing (the OS/2 logo and a serene lighthouse ocean landscape are provided), then switch to a floating padlock. No unauthorized entry is permitted, and you can get back to your work by typing in your password.

OS/2 FEATURES A SUPERIOR INTERFACE

33 THE WORKPLACE SHELL PROVIDES A STRONG APPLICATIONS FOUNDATION

After installing OS/2, the Workplace Shell appears with a predetermined selection of tools and folders that will help to familiarize the OS/2 novice with the system's capabilities. For instance, the Drives object offers a fast path to file manipulation, and the Productivity Folder contains a selection of information management and time management tools.

But these are only the beginning. OS/2 has no menu bar, so you have a wide-open space on which to install the objects that you create and applications that you need. And the ability to place folders within folders—on a virtually infinite basis—lets you sort and arrange objects exactly how you work. As a result, the Workplace Shell has the ability to be as comprehensive or as simple as the situation requires.

OS/2 menus also provide a context, offering only the commands that are available from that point in the interface. This gives you a clear idea of the choices available in each situation, and doesn't bog you down with irrelevant commands.

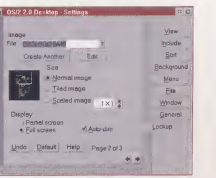
34 THE SETTINGS NOTEBOOK CONTROLS OS/2 OBJECTS

When you click on an OS/2 object and select the "Open Settings" menu sequence, you call up the Settings Notebook. Here, through selecting tabs that represent various categories, you select how this object will behave. The Settings Notebook allows you to easily fine-tune options such as associating files and modifying icons, as well as control window activity.

The Settings Notebook is truly context sensitive; you are only given choices that will directly affect the specific object. For instance, the Lockup settings let you determine the delay before the screen saver begins, pick or add a bitmap image, tile or scale the bitmap image, and enter or change your password. The tab-driven interface makes the choices clear.

DECORATING THE DESK

The behavior of each OS/2 object is controlled through the Settings Notebook. This tab-driven module allows you to customize every aspect of the object, in a way that is clear and easy to understand.



35 OS/2'S OBJECTS ECHO COMMON DESKTOP METAPHORS

Under OS/2, a Desktop object falls into one of four categories:

File. OS/2 further develops the traditional file-as-data-receptacle metaphor. Files hold data and are tied to applications. So a "Memo" created in DeScribe sits on the Desktop, where clicking on the icon loads the file and the application in one step.


Config.sys

Program. This includes standard application programs, utilities and tools. A program object, independent of a file, is positioned on the Desktop for easy access and in many cases controls system functions.


Window Washer

Device. A device qualifies as any peripheral that connects OS/2 with the outside world: A printer, FAX, modem, network or disk drive all appear as Desktop objects. The Shredder—essentially the OS/2 delete command—is also represented in the same way.


Shredder

Activating a device object is simple and straightforward: You highlight the file and drag it over the device to execute the command. Where appropriate, a dialog box appears to confirm the command.

Folder. The OS/2 folder acts like its analog counterpart, containing several disparate parts that all relate to the same subject. It may contain a combination of files, programs and devices, all pertaining to a single task or project. You can also install a folder within a folder (or an object within a folder)to build a hierarchical series of objects.


Games

36 OS/2 TEMPLATES SET THE STAGE FOR CUSTOMIZED DATA ENTRY

The OS/2 Templates folder, installed with the Workplace Shell, allows you to instantly create objects and install them on the Desktop. Any item in the OS/2 Templates folder can be highlighted, dragged to another location, and opened as a custom file, where it becomes the appropriate database, spreadsheet or document for data entry.

In addition, many OS/2 applications place a custom template into this folder during installation. For instance, to create a memo you may highlight the DeScribe Template and drag it to the Desktop or into a new folder. Then, Alt-single click on the title and modify it accordingly. It's much like a pad of paper, where you tear off one sheet at a time. Under OS/2, each sheet of "paper" harnesses all the full power of the operating system. So instead of a pad of paper you can have a pad of spreadsheets.

37 WORK-AREA FOLDERS KEEP YOU ORGANIZED

Keeping track of information and programs related to a project is simplified with work-area folders. A work-area folder looks like any other folder object, but the biggest difference is that anything you keep in that folder is closed and saved whenever you close the folder. And, when you reopen the folder, everything in it is restored to the view in effect when you closed it. So, OS/2 works along with you.

Imagine a project which includes several reports, a spreadsheet, and a printer with custom settings. All can be kept in a work-area folder, always opening to the view in effect when you last left the project. If you hide or minimize the folder, everything in it hides or minimizes at the same time. When you show the folder, everything reopens. One example of a work-area folder is the OS/2 Desktop itself. The Desktop is actually a work-area folder which remembers object placement and open objects whenever you close the folder by shutting down.

GROUP YOUR FILES LOGICALLY BY PROJECT

With OS/2's Work-Area Folder option, you can easily group files and applications that pertain to a specific project by using the Settings Notebook.



Create a work-area folder by clicking the right mouse button on a folder, choosing Open, then Settings, and then the File tab. Just click "Work area" and the folder is now a work-area folder object.

38 THE WORKPLACE SHELL IS A GREAT ORGANIZER

The Workplace Shell is more than a digital desktop from which you launch computer applications. The most significant difference between Workplace Shell, the touchstone of OS/2, and the controlling interfaces of other operating systems is that it is completely customizable. There are no fixed objects in the Workplace Shell. You can easily add or delete any system or program function and include as many or as few commands on the Desktop as you wish.

Furthermore, almost all aspects—fonts, colors and icon arrangement—are easily customizable, with a minimum of reference to documentation. In most cases, these changes only require a simple drag-and-drop command.

More significantly, the Workplace Shell is completely object oriented—each Desktop object offering a direct path to a file, program, device or folder. This brings a real-world metaphor to the computer Desktop, as every object on an office desk falls into one of these categories.

Everything within OS/2 has a frame of reference to the "real world." And like your own desk, access to the contents of the object is immediate. You don't need to issue commands to load a program or open a file in order to access the object's contents. (Similarly, you don't need to say things like "Alt-File-Open-Budget" to open a paper folder with a spreadsheet inside.)

39 TIP: THE ORGANIZATION DESKTOP

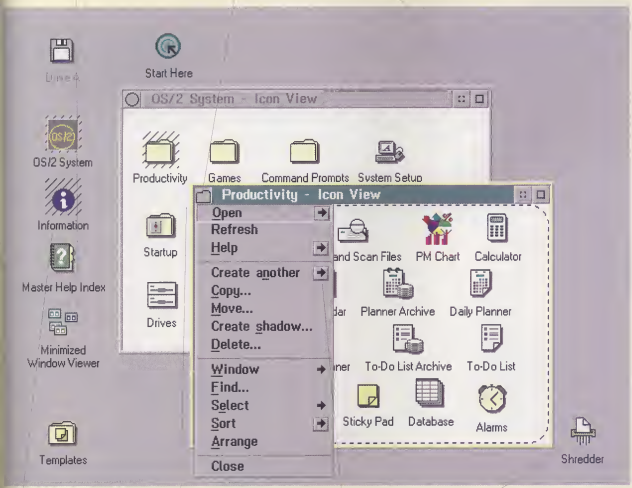
If you have a lot of windows open and need to get something from the Desktop, it takes time to hide or move all the windows. Make the Desktop accessible by making a copy of it in a window. Then, you can use the Window List (CTRL-ESC) to select the copy and bring it to the top. First, click the right mouse button on the Desktop background, choose Open and Settings. In the Settings Notebook, choose the Window tab. In the "Object open behavior" area, click "Create new window." Close the Settings Notebook.

Now, open a copy of the Desktop in a window from the Desktop itself. Click the right mouse button on the Desktop background, and choose Open and any view you desire (Icon, Tree or Details). You can dismiss the new Desktop window at any time in the same way you'd close any window. Conveniently, you can arrange the icons in the window into a view that's best for a particular task, and a copy of the Desktop can be in Details view while the normal Desktop itself reflects icon view.

The Minimized Window Viewer offers an icon view of all open applications. You can also get a task list with a simultaneous left/right mouse click anywhere on the Desktop.

The upper left-hand corner of every window contains the program icon for the active application. This gives each OS/2 window an individual nature and offers an immediate visual clue about the window.

Hide, Minimize and Maximize commands are part of every OS/2 window. A single click on the small square hides the application but keeps it active. A single click on the large rectangle toggles between full screen and windowed size.



The shading on a Workplace Shell object indicates that the application is currently active. A double-click motion accesses the open copy of the object directly.

OS/2 allows objects and folders to be nested within other folders. As you progress from one folder to another, each is automatically cascaded on the Workplace Shell surface.

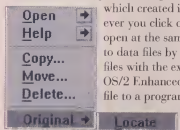
OS/2 menus provide all the choices available for a particular object, along with the context. Here, the menu commands control the area within the dotted line.

When a device object is represented anywhere on the Desktop, you can drag-and-drop another object to execute a function. Dragging a file over the shredder object would delete that file.

40 OS/2'S ABILITY TO LINK FILES AND APPLICATIONS BUILDS A DIRECT PATH BETWEEN THE USERS AND THEIR DATA

OS/2 makes it easy to connect data files with the appropriate application. You can create this link directly, or even make "shadow" copies, where icons in different places link to the same object. Either way, a single double-click will open both your file and the program you need to run it, ending frustrating minutes of trying to remember which application created which bit of information.

OS/2 does this by creating an association between a program object and data-file objects. You can associate files to programs in three different ways. The first ties the type of file (e.g., a spreadsheet data object) to the program which created it (e.g., a spreadsheet application). Whenever you click on the file, it and the spreadsheet program open at the same time. The second links a program object to data files by a part of the file name. For example, all files with the extensions DOC or TXT could launch the OS/2 Enhanced Editor. The third way associates a single file to a program name by listing the program as an option on the data file's Open menu.



A single right-mouse click calls a pop-up menu, which offers the available options for a link to another file, application or folder.

A way to maintain access to an object from multiple areas without duplicating the object itself, is to use OS/2's shadows. And, when you manipulate information in a shadow, the information in any other shadows and the original is also changed.

TIP: ME AND MY SHADOW

Instead of using the object's menu to make a shadow, simply press Ctrl and Shift while you click and hold the right mouse button. Drag the object to any folder and release the mouse button. Voila! A shadow appears!

TIP: THE UNIVERSAL DRIVER

Thinking of changing mice and don't know what mouse driver to select? OS/2 intelligently detects and installs the correct mouse driver. So don't worry if you're not prompted during installation for your mouse type—OS/2 has sensed it and installed a driver which works.

41 OS/2 HAS STYLE

It's easy to personalize OS/2's interface to reflect your own taste and style. The primary tools to do so—tools controlling color and fonts—are in the System Setup folder within the OS/2 System group... just four mouse clicks away from the Workplace Shell's opening screen. Here, you give each window, folder and object its own color and font scheme and bring a new level of personality to the Desktop.

With the Color Palette, you select the desired hue with a single right-button click, at which point the cursor changes into a paint roller dripping with that shade. You drag the cursor to the destination—a window, menu or Desktop—and release. The color changes instantly. Similarly, to modify the font on any menu or window, you highlight a type style on the Font Palette and drag it to the target.

The Scheme Palette allows you to customize colors and fonts for individual windows or across the system in one action. The described Color Palette and Font Palette actions only affect the target windows, or you can hold the Alt key to make the modification work universally.

IN LIVING COLOR

Both the OS/2 Color Palette and Font Palette allow you to customize visual preferences. A drag-and-drop action changes these aspects in one program or across the system.



42 THE OS/2 MOUSE OFFERS SHORTCUTS TO POWER

While OS/2 provides several convenient keyboard shortcuts, the heart of user interaction with the system comes from that trusty denizen of the digits, the mouse. It is the mouse, in fact, that gives the user complete control over OS/2 commands, in a powerful, intuitive way. Nevertheless, using the OS/2 mouse involves more than just point-and-click.

In addition to drag-and-drop, the right mouse button brings up a context menu, allowing you the choices that are available from that point in the interface. Another universal OS/2 mouse command is the simultaneous left/right single click anywhere on the Desktop, which brings up the active Window List.

These options can be customized through the Mouse object in the System Setup group. Here, you adjust the mouse for left-handed or right-handed operation to suit your style, or remap different buttons to drag-and-drop, or call up the Window List. You also determine the combination used to change the Desktop title. (Alt-left button is the default.)

43 POP-UP MENUS GIVE USERS CLEAR CHOICES

Pop-up menus show exactly what you can do at any given time. Clicking the right mouse button anywhere on the Desktop opens a pop-up menu, which controls the most important Workplace Shell functions. Besides the ability to arrange and sort all Desktop objects, this menu controls password lockup and shutdown. Like other OS/2 menus, this feature shows only the choices that are available from that point in the interface.

You can add choices to the Workplace Shell simply by modifying the pop-up menu.



TIP: CHANGE THE CHOICES

OS/2 allows users to change the context and add choices to the menu. For instance, you may want to add file search capabilities, so you would do the following:

1) Open the Settings Notebook and select the Menu Page.

2) Click "create another" below the primary pop-up menus field. Type the menu item name, path and filename (in this case, C:\OS2\APPS\PMSEEK.EXE) of the desired application into the pop-up dialog box.

3) Close and exit. The program then appears on the bottom of the system menu.

These modifications are reflected only in the individual menu, so if you change the choices in the Drives window, it doesn't affect menus anywhere else on the Workplace Shell.

44 TIP: POWER TO THE KEYBOARD

If you want to select an object on the Desktop without having to "mouse around," type the first letter of the object (e.g., "O" for OS/2 System) and you'll jump right to that object. If there's more than one object that begins with the letter (e.g., "M" for Minimized Window Viewer or Master Help Index), typing the first letter repeatedly will go to every object that begins with that letter. Then, hit ENTER to open the object.

45 THE OS/2 MOUSE IS AN ARTFUL DRAG-AND-DROP TOOL

OS/2 relies on the right mouse button to complete drag-and-drop commands, allowing you to control objects in an intuitive way. You highlight a file or an object with a single right-button click, then hold the button down and pull it to the desired location: Inside another folder, to a device or onto the Desktop. Releasing the button executes the function.

Drag-and-drop isn't restricted to a single item. If you highlight a file or object with the left mouse button and drag it across another file or object, this highlights both items and allows you to execute a single function like print or shred.

Mouse/key combinations also help to execute the drag-and-drop functions. Ctrl-right mouse button makes a copy of any file or object, which can be moved to any folder.

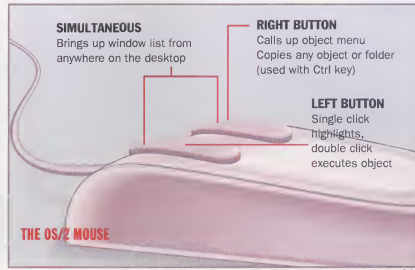
46 TIP: UNTRAPPING THE MOUSE

If your mouse disconnected or died sometime during an OS/2 session, don't panic. Press CTRL-ESC to bring up the Window List. Use the arrow keys or type "O" to select the OS/2 Desktop, and press ENTER. Hold down CTRL and the \ key to de-select any selected icons. Finally, Press SHIFT-F10 to bring up the Desktop menu, and use the arrow keys or type "D" to shut down.

47 THE OS/2 SHUT DOWN COMMAND PROVIDES A VIRTUAL BOOKMARK

Many users, when they are finished with their work, are inclined to just save the current files and turn off the computer. Under OS/2, it's better to use the Shut Down command (part of the Desktop Menu, accessed through a right-button mouse click on the Desktop) to save all open objects, folders and programs. Following this, it offers the option to save or abandon changes in a DOS or Windows session. At the next startup, everything goes back to where you were. This extends the comparison to a standard desk: When you come to the office in the morning, your desk looks the same as the night before.

Some of today's computing envi-



ronments require around-the-clock operation, so you may only use Shut Down if you want to move the system, add expansion cards or turn the computer off. Turning off the power in the middle of an OS/2 session may damage the PC's initialization files and corrupt the Desktop, even if all of the files are saved.

48 TIP: CLEAN YOUR DESK

To start with a clean Desktop at startup, hold down the left CTRL, left SHIFT and F1 keys simultaneously from the moment the mouse pointer appears until icons are displayed on the Desktop. This will disable automatic restart for the current session only.

Another method is to add a line to the CONFIG.SYS file. Use the System Editor or Enhanced Editor (in the Productivity folder under the OS/2 System object) to open CONFIG.SYS. Add the line: SET RESTARTOBJECTS= STARTUPFOLDERSONLY. Save the file and reboot. It'll keep disabling the automatic reloading of open applications, except those in the Start-up folder.

OS/2 COMES EQUIPPED WITH EVERYTHING YOU NEED TO GET STARTED

49 OS/2 ARRIVES WITH A HANDFUL OF ESSENTIAL UTILITIES

Right out of the box, OS/2 provides well-thought-out adjuncts to a fully functional operating system. With the included "applets," IBM is priming the pump with a range of utility programs, which demonstrate the 32-bit environment in graphics, communication, system and time management areas.

Included as part of the Productivity Folder in the OS/2 System group, OS/2's applets help to acquaint you with the OS/2 interface and menu structure as you complete these tasks. For instance, you can change the font size and the color of any of the OS/2 applets, or control the menu typefaces with the font palette.

TIP: YOU CAN CUSTOMIZE THE LOOK OF ANY OS/2 APPLET

Every OS/2 applet has a Customize menu item, which lets you to select the colors of program components and the font size: From a tiny 10 x 6 to a commanding 10 x 22.

50 OS/2 INCLUDES A SPREADSHEET AND A DATABASE

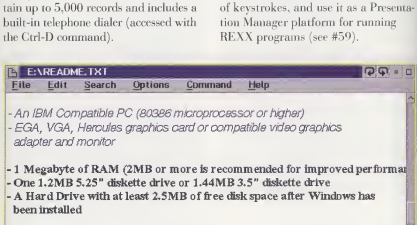
Ten years ago, the spreadsheet and database included in OS/2 would have been sold as standalone applications. The 26 column x 40 row spreadsheet allows you to track monthly expenditures, sales figures or any other numerical data. You can also write and execute simple formulas.

The OS/2 Database allows you to create up to eight fields and is ideal for the maintenance of phone lists or simple data projects. Each database can contain up to 5,000 records and includes a built-in telephone dialer (accessed with the Ctrl-D command).

51 OS/2 HAS TWO BUILT-IN TEXT EDITORS

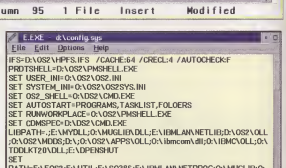
OS/2 includes two text editors, one for editing and creating text files and another for programming and light word processing. The System Editor can create and edit CONFIG.SYS and AUTOEXEC.BAT files. It's also a convenient tool to display other text files or perform basic editing tasks. You can start several versions of the System Editor so you can edit several files in separate windows. System Editor easily handles text files up to 32 KBs in size.

The Enhanced Editor takes text editing several steps further. You can work on multiple files at the same time. It runs from a menu or command line. Text is drag-and-droppable under Presentation Manager®. You can record and playback keystrokes, choose the font and font attributes, automatically save files after a number of keystrokes, and use it as a Presentation Manager platform for running REXX programs (see #59).



OS/2 HAS TEXT APPEAL

The OS/2 system includes two text editors. The System Editor (top) handles files of up to 32 KB, and is used for editing system and .BAT files. The Enhanced Editor (bottom), with font support and drag-and-drop text, can be used for light word processing chores.





TALKING BACK

OS/2's PM Terminal is a good introduction to 32-bit telecommunications. It comes pre-configured with protocols and numbers for the most popular online services, and allows you to upload or download large files in the background while working on another task.

55 A CHARTING PROGRAM TAPS THE GRAPHICS POTENTIAL

PM Chart has a variety of drawing and charting tools to ease the creation of business graphics. And it comes free with OS/2.

PM Chart has a worksheet for entering data you want to chart. Charts (and other functions) are chosen from icons on a tool bar. You can present your data in a variety of chart types including area, bar, column, line, pie, exploded pie and table, with options for legends and 3D perspective. For drawing, PM Chart can import and manipulate clip art, create arcs, rectangles, ovals, lines and freehand objects, and align objects. In addition, charts and drawings can be annotated with text, printed and copied to OS/2's clipboard.

52 A TERMINAL PROGRAM CONNECTS YOU TO AN OUTSIDE 32-BIT WORLD

PM Terminal is OS/2's built-in way of getting you hooked up to online information services and other personal computers with your PC's modem.

PM Terminal, in technical terms, handles asynchronous communications and terminal emulation using the OS/2 Workplace Shell. This lets you communicate with other computer systems and transfer information. When you launch PM Terminal, you'll find it comes configured with a variety of profiles for CompuServe, GEnie, IBM's own OS/2 bulletin board system, and other services. These profiles are easily changed, or you can add your own (perhaps to hook up with a local computer bulletin board system or a friend's personal computer). PM Terminal also lets you record frequently used keystrokes as macros.

TIP: ICON BE CREATIVE.
While running a DOS graphics program in a window, use the graphics cut-and-paste feature to clip a picture and paste it into the Icon Editor. You can then quickly and easily create customized icons for all of your applications.

53 BUILT-IN DISK CACHING SPEEDS ROUTINE OPERATIONS

Routine disk read and write operations take time and decrease responsiveness. OS/2 deals with this by including disk caching as a standard feature. As disk operations typically are the slowest aspect of computing, executing as many functions as possible in memory will speed overall operations. Furthermore, a cache reduces wear and tear on your disk because the CPU is not going to disk as often.

OS/2 automatically selects the size of the disk cache when you install the operating system, based on your installed memory, disk size and file system (the default for a system with 4 MBs RAM is 128 KBs). However, you can adjust the size of the disk cache after installation by using the DISKCACHE command in the CONFIG.SYS file.

54 OS/2'S STICKY PAD HELPS TO MANAGE RANDOM INFORMATION

One of the most popular and useful DOS utilities was the Sticky Pad, a way to capture the random information that makes every business day confusing. OS/2's embedded Sticky Pad, located in the Productivity Folder, has none of the irregularities of the DOS-based memory resident programs. Instead, it looks just like the pad you put on your refrigerator. You can write a new note and "tear" it off (through a drag-and-drop motion) and place it on the Desktop.

With the Sticky Pad, you can enter any information—text or numeric—before deciding to which application it belongs. After that time, you highlight the text and copy to the clipboard, and then paste it into the appropriate application. Or you can minimize individual notes on the Desktop, where they are indicated as small numbers across the bottom of the screen.

56 OS/2'S TUNE EDITOR IS AN INSTRUMENTAL UTILITY

The OS/2 Tune Editor allows you to create and edit tunes to be used with the Alarm utility. You can write, edit and play up to 36 individual tunes of up to 20 notes each. Four sliding bars adjust for value, note, tempo and pitch, and you can work on either the bass or treble clef (although the Tune Editor can play only one note at a time). And you can tie these sounds to any Alarm reminder to keep you on schedule.

The possibilities are virtually endless: You can open each computing day with "Reveille," and close with "The Minute Waltz"... or be considerably more imaginative and create your own compositions.

TIP: A 32-BIT REMINDER

Need a reminder to back up your hard disk? How about launching the backup program automatically? OS/2's built-in Alarms application is just the tool. Choose "Set Alarm." In the Comment line, type the name of the .EXE or .COM file you want to launch (with the complete path, if it's not in the same subdirectory as Alarms). Choose the day, hour, minute and other settings, making sure you check the "Execute comment as command at Alarm time" box. Click on the Set button. Close the Set Alarm window, and hide (don't close) the Alarms application. (If you close it, the Alarms don't function). When the appointed hour arrives, your application will launch.

57 A BUILT-IN SEARCH CAPABILITY HELPS FIND LOST FILES

With the average hard disk exceeding 100 MBs, it becomes impossible for users to remember what information is in which file. Therefore, one of the most popular and useful add-in utilities in the DOS environment is Text Search, where users can instantly comb a disk for a certain phrase or data string. Under OS/2, Text Search is a system-level utility (Seek and Scan Files, in the Productivity Folder of the OS/2 System group), that is fast, thorough, and, best of all, included at no extra cost.

The program is simple and straightforward: You type in the files to search, such as *.DOC, a text or numerical string of any length, and the drives to search. After a few seconds, the files that contain that string will appear in the "Files found" window. You can then open the file by dragging the file name and dropping it upon the Enhanced Editor icon (as long as the Enhanced Editor is loaded).

MATCHLESS BATCHES

Users with a minimum of programming knowledge can streamline their computing routines with OS/2's REXX procedure. This produces powerful batch files to execute complicated, automated functions.

58 AND GAMES ARE INCLUDED

One of the most popular Microsoft Windows applications is the Solitaire game that is included with the system. OS/2's version, Klondike Solitaire, leads the pack of the included games. This includes two puzzle games, a graphical chess game and Reversi, the popular strategy game that is no longer available under Windows.

OS/2 games provide a way for you to have fun with the system, practice your "drag-and-drop" technique, and take a break from the routine. In between spreadsheet recalcs, for instance, you may want to fit in a round of chess against the computer. Or you can squeeze in a few games of Solitaire during a download.

TIP: PLAY CAT AND MOUSE WITH THE CURSOR

If you have trouble seeing the mouse pointer while using a gray-scale or monochrome monitor built into a laptop PC, there's a remedy. The most visible—and fun—is to go into the Games folder (in the OS/2 System object). Double-click on the Cat and Mouse object. Now, hide the Cat and Mouse program by clicking on the appropriate box, so Cat and Mouse keeps running while you're working.

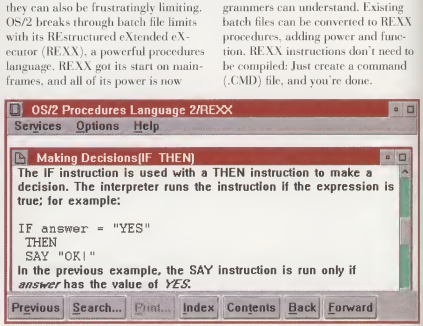
An animated cat will chase your mouse pointer across the Desktop, compensating for the invisibility of the cursor caused by rapidly moving the mouse. (The cat will even follow the mouse pointer behind open windows.)

(Cat and Mouse is actually designed as a tool to teach you to use the mouse. It's easy to disable when you get tired of it. Just click CTRL-ESC to bring up the Window List, and click on Cat and Mouse. Either close the window by double-clicking in the upper left hand corner, or, under the Actions menu, choose "Disable cat.")



59 OS/2 HAS A POWERFUL SYSTEM-WIDE PROCEDURES LANGUAGE

If you've ever written DOS batch files to automate functions, you know how convenient they can be. But they can also be frustratingly limiting. OS/2 breaks through batch file limits with its REstructured eXtended eXecutor (REXX), a powerful procedures language. REXX got its start on mainframes, and all of its power is now part of OS/2. And it's accessible power. REXX lets you produce what you might think of as a super-batch file. However, it uses common English words and a natural syntax flow which both beginning and experienced programmers can understand. Existing batch files can be converted to REXX procedures, adding power and function. REXX instructions don't need to be compiled: Just create a command (.CMD) file, and you're done.

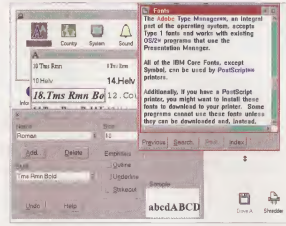


TIP: THE FIND COMMAND HELPS YOU PREPARE

The Find function, on the main menu of the Workplace Shell, takes text search to the next logical step. You type the text that you need, such as "Budget," and direct the program to search all folders. It then creates a new folder that contains all the file objects that contain the word "budget." So if the boss asks to see all the budget file, they are but a few keystrokes away.

JUST YOUR TYPE

Adobe Type Manager, the font technology favored by design professionals, is part of the OS/2 system. Combined with OS/2's convenient drag-and-drop fonts, ATM adds real type flexibility.



OS/2 IS A SUPERIOR APPLICATIONS PLATFORM

60 OS/2 IS A NATURAL ENVIRONMENT FOR PORTABLE COMPUTING

Multitasking is a necessary feature on the desktop, but it can be absolutely essential on the road. The major multitasked functions for OS/2 computing will be printing and communication, used in conjunction with your primary application. On the road, when both time and battery life are at a premium, you don't want to spend many minutes staring helplessly at the screen while the computer sends and receives a large file. So with OS/2, you can be downloading one message as you respond to another.

OS/2's ability to multitask communications and other applications makes it a natural for portable computing, especially since most of today's new notebook computers have the power to run the system at peak efficiency. As OS/2 evolves, IBM will continue to add exciting capabilities that will enhance portable computing.

61 WITH OS/2 SPREADSHEETS, COMPLEX CALCULATIONS DON'T STOP EVERYTHING

A spreadsheet may seem mundane, but it only takes the OS/2 multithreading capability to make it more interesting. For example, Lotus Development Corporation's 1-2-3 for OS/2 uses multiple threads to make resource-intensive procedures run in the background. 1-2-3's Solver utility is used to perform complex optimizations that may involve many variables and may take as long as ten minutes to run. With the DOS versions of 1-2-3, the user must stop working in the spreadsheet while Solver performs a task. But with the OS/2 version of 1-2-3, Lotus has given the Solver its own thread. This means that a Solver process can run in the background while the user continues working with 1-2-3. And printing runs as a separate thread, so it won't slow you down.

62 OS/2 PROCESSES WORDS WITH FLAIR

Pundits once thought that word processing, of all the major applications, would benefit least from 32-bit power. Not true. A capable 32-bit word processor, DeScribe, is already on the market and market leaders WordPerfect*, Computer Associates and Lotus* intend to enter the category in 1993. Some of the advantages are obvious, like the ability to print one document while continuing to work on another. Others are more subtle: DeScribe interacts with the Workplace Shell, and allows you to drag a document icon onto the INSERT icon to enter that document's contents into an open DeScribe file.

This process allows corporations to create lengthy "boilerplate" documents, invoices, statements, etc., and easily insert them in whatever order fits the situation.

63 OS/2 INCLUDES ATM, FOR STATE-OF-THE-ART TYPE MANAGEMENT

OS/2 is also the only PC operating system to include Adobe Type Manager* (ATM) as part of the system software, without requiring the user to buy or install another type package. ATM (included here for both Windows and OS/2) is the font management technology that's been adopted as the standard by designers for sharp on-screen type rendering. This makes it easier to kern type and change leading. ATM also speeds printing of heavily formatted documents.

64 OS/2 PUTS MORE PUNCH INTO GRAPHICS

Better performance, more color and greater productivity turn OS/2 into the best environment for creating graphical output.

The coming OS/2 32-bit graphics engine will be enabled to support up to 16 million colors, so designers and illustrators are no longer limited by computer color technology. OS/2 will redraw a large file or save it to disk as much as 25% to 30% faster. Even manipulations of complex images occur more quickly. And the OS/2 multithreading capability means that users can print large graphics files in the background while working on another image in the foreground. OS/2 transparently manages the complexity so users can be more productive.

65 OS/2 DATABASES CAN SPEED OPERATIONS BY HALF

As personal computers become more powerful, database management systems are required to manage larger, more complex databases. But no matter how powerful the hardware, database performance is ultimately determined by the underlying operating system. Getting 32-bit performance out of a DOS database, for example, requires extender technology and extenders impose a significant performance penalty. Because OS/2 is a 32-bit, multitasking operating system, OS/2 database management systems can provide extremely fast processing of large databases.

Suppose, for example, a user needs to perform a join on two tables, each of which holds several rows. With a DOS database, data in each table would need to be read sequentially before the results could be returned. With a multithreaded OS/2 database, concurrent threads could read each table simultaneously, before combining them into the join and returning the results. This capability reduces the time required for the join by as much as 50%.

66 OS/2 IS A LIVELY SHAREWARE PLATFORM

The shareware market, which allows users to "try before you buy," has a large, rapidly growing set of useful, engaging and fun OS/2 programs—all available for download from bulletin boards worldwide. Logging onto a BBS, in fact, may be the best source for interesting icons, bitmaps, screen savers and games under OS/2. And under OS/2, you can continue to work during the download.

In addition, you can also find business-based utilities and system accessories in shareware outlets. For instance, JP Software's 4OS2 is an alternate command processor that strengthens the OS/2 command line. (The company also makes the popular 4DOS.)

TIP: EXPLORE THE WORLD OF OS/2
If you want to log on to an OS/2 related BBS, find a file with OS2WORLD in the title, for example OS2WOR.ZIP on CompuServe. You'll get a list of OS/2 BBS's worldwide.

OS/2 IS A SUPERIOR NETWORKING PLATFORM

67 EXTENDED SERVICES EXTENDS YOUR COMPUTING POWER

To supplement OS/2 on a standalone PC, IBM offers the Extended Services package. This expands the power of OS/2 over your local area network (LAN) with two powerful software packages: IBM's Communications Manager (an SNA gateway) and IBM's Database Manager (which can also be used as a standalone system). Extended Services gives you the power to access remote files, communicate with outside information services, and record transactions—all at the same time. Use it to support peer-to-peer networking operations and distribute computer processing demands. Even work with applications across environments that have different connectivity, communications protocol, operating system and hardware requirements.

Ultimately, OS/2 Extended Services makes it easy to link your PC to needed information.

68 COMMUNICATIONS MANAGER HELPS TO MAKE THE CONNECTION

Getting information from one PC to another computer in an office—or around the world—can be a daunting task. Communications Manager provides a "no barriers" approach to accessing this data on compatible mainframes, minicomputers and personal computers.

Communications Manager links you to a variety of IBM and non-IBM applications running on host computers. It does this by emulating ASCII, IBM 3270 and IBM 5250 terminals. Since OS/2 is a multitasking operating system, you can simultaneously transfer files to and from several different hosts. The peer-to-peer communications capabilities let different OS/2 workstations on a network share resources and tasks. Support of the Network Device Interface Specification allows you to pick the best network interface card for your hardware from a variety of manufacturers. It also allows you to connect to multiple hosts off a single card.

69 DATABASE MANAGER MAKES INFORMATION COUNT

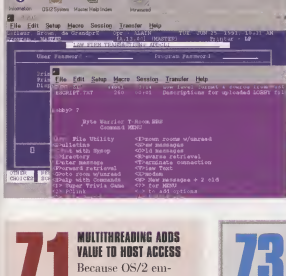
Database Manager adds standalone database functionality to your OS/2 workstation. It is a relational database with SQL (Structured Query Language) compatibility, letting it speak the language of IBM host data management systems like SQL/Data Systems and DATABASE2 (DB2). Issue SQL statements, commands and utilities directly from the OS/2 command line. Or it can use a friendly graphical interface for querying, reporting, data entry and editing, and creating tables. Even DOS and Windows applications can get information from OS/2 Database Manager databases, with no need to learn SQL syntax to access, update and administer data.

If you want to put network database information in a central location, look to the optional OS/2 Extended Services with Database Server. Database Server acts as an information host for the Database Manager clients on your network. It provides OS/2, DOS and Windows client applications access to remote OS/2 database servers, making it seem as though the data hosts were managing the information right at your desk. Plus, it has all the features of the regular Extended Services package.

70 OS/2 STREAMLINES HOST ACCESS

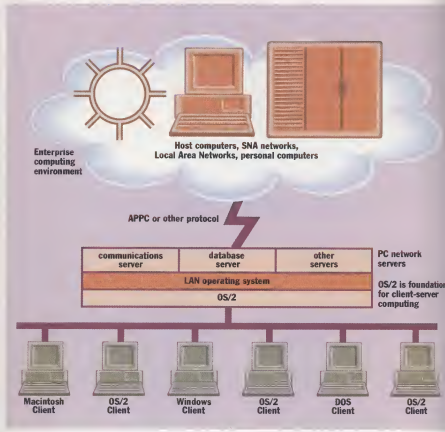
In the complex computing environments found in large, multinational corporations, personal computers frequently need to access multiple hosts. OS/2 was designed to simplify and stabilize the process of sharing data among diverse computing systems.

Because PC-to-host communications are frequently incorporated into important business applications, a protected system is vital. OS/2 provides a stable communications environment, protecting the PC-to-host connection from the failure of other applications.


Information
CIS/OS Bypass
Mouse Help Index
Firewall
File Edit Setup Macro Session Transfer Help
User Journey:
Program Journey:
File Edit Setup Macro Session Transfer Help
Bytes Waiting: 7
Byte Worker T-Xmon BBS
Connect MENU
Main Menu Utility
Mail Utility
Chat with Sysop
Directory
Voter Registry
Password Retrieval
Check room statistics
Page Sysop for Chat
Read Trivia Game
Set Prefs
Leave a Message
Read Your Mail
Read Bulletins
Change Your Password

OS/2 PROVIDES FOUNDATION FOR ENTERPRISE COMPUTING

O/S2 was designed to support the exchange of data throughout an enterprise. By choosing OS/2 as the foundation for a network operating system, corporations can support client computers running diverse operating systems while ensuring access to the entire corporate computing structure. Powerful network server products like IBM Database Manager and Lotus Notes make client-server computing a way to speed delivery of information at reduced cost.



77 OS/2 CONNECTS YOU TO DATA ANYWHERE ON THE NETWORK

OS/2 not only brings high performance and bullet-proof protection to the client-server network, the operating system also provides a platform for finding and sharing data from wherever it may reside in the corporation. With IBM Extended Services version 1.0, desktop PCs communicate with any computer that supports Advanced Program-to-Program Communications (APPC). This means that any OS/2 enabled computer talks to any system that supports this universal protocol.

And when IBM's Extended Services are added to a computer running OS/2, that computer may access data from any system on the network running APPC—from PCs, Macintoshes®, UNIX workstations, AS/400s, and many other types of minis and mainframes. This turns a network running wide area network protocols into a framework for "extended" client-server computing. OS/2 Extended Services makes this more than simply a pipeline to a host system and provides access to virtually any computer on the network.

When Advanced Peer-to-Peer Networking (APPN) is added to the communications mix, application installation, configuration, and network management become easier. OS/2 is now the only desktop operating system that supports APPN, giving it the ability to go virtually anywhere.

78 TIP: WHERE TO FIND OUT MORE ABOUT APPC

To access the APPC Info Exchange Forum on CompuServe, type GO APPC at the ! prompt. IBM has created the APPC Market Enablement Group especially to inform software vendors and application developers. This group publishes a newsletter on APPC, APPN and CPI-C, along with a directory on APPC training and products. The group also holds conferences for developers and vendors and provides hands-on training courses. The APPC Market Enablement Group can be reached at (919) 254-4957 or via Internet to appcmrkt@vnet.ibm.com.

79 OS/2 MAKES THE NETWORK ADAPT TO YOU, RATHER THAN THE OTHER WAY AROUND

Finally, we have transparent networking. OS/2 gives you an easy way to customize your networking environment via the Workplace Shell. Because the Workplace Shell is object-oriented, it graphically represents a network operating system, such as IBM LAN Server. So you are treated, for example, to a graphical display of all the available services on the network through OS/2's resident Desktop. A remote device will appear to be local.

OS/2's rich set of networking capabilities provide the user with customized network resources for maximum productivity, and a development platform where rich business applications can be created. Selected servers are grouped into "domains." Then, when you select a server, it displays the associated resources. You can then assign resources a "local identifier" (a local drive designation). After following this simple, object-oriented procedure once, the selected resources appear as local resources.

80 TIP: GOING PLACES IN THE WORKPLACE SHELL

You can use the OS/2 Workplace Shell to include remote objects and resources in your local machine Desktop configuration. With the Workplace Shell Network Object, you navigate to remote objects by pointing and clicking with your mouse. The Network Object is a folder in the Workplace Shell; the objects within the folder are server objects. After selecting a server, use standard Workplace Shell procedures to include remote objects in your Desktop configuration. For example, by holding down the Ctrl key and the right mouse button on a remote object, you drag a "shadow" of that object onto your Desktop. Once a remote object is in your Desktop configuration, you work with it just as easily as with local objects.

OS/2 IS A SUPERIOR DEVELOPMENT PLATFORM

81 OS/2 PROVIDES A POWERFUL PLATFORM FOR SERVER-BASED APPLICATIONS

OS/2 gives applications developers a powerful platform for developing complex applications. With features like protected-mode memory, a full 32-bit flat memory model, and multiple threads, developers can write robust 32-bit business applications. For example, a customer database application developed in Lotus Notes may reside on a server in Chicago. Notes uses the multiple thread capabilities of OS/2 to automatically replicate the customer database to other network servers located in other cities. In effect, the servers are dynamically calling one another to replicate and update the database. Remote users are able to call into the nearest database and have the server copy the customer database onto their PC. And only the changed records are updated.

82 OS/2 PROVIDES A PLATFORM FOR DESKTOP APPLICATION DEVELOPMENT

OS/2 provides application developers with a protected, productive environment for developing DOS, Windows or OS/2 applications. Within a single OS/2 system, a developer can concurrently design, edit, compile, test and debug for three popular operating systems, as well as those for mini and mainframe systems.

OS/2 gives developers the ability to run multiple processes simultaneously. Given the complexity involved in the programming of elaborate applications, this provides a major productivity gain.

For example, a developer may compile a program in the background while testing another program in the foreground. If and when the foreground process fails, the compilation will continue unaffected. As a result, the development process progresses much more quickly and smoothly.

83 OBJECT ORIENTATION STREAMLINES DEVELOPMENT

OS/2 includes a language-neutral, object-oriented programming mechanism called the System Object Model (SOM). SOM is specifically designed to support a new, object-oriented structure, and to be usable with both procedural (non-object-oriented) languages and object-oriented languages. IBM developed the Workplace Shell by using the set of objects and classes included in SOM, and these are available to all OS/2 programmers to speed the development process.

The object-oriented approach employed by SOM gives developers a significant advantage over older procedural programming techniques. SOM is not a programming language, but a system for defining, manipulating and releasing object-oriented class libraries. SOM consists of a runtime library and a set of utility programs that support building, externalizing and manipulating software objects. SOM is used to define classes and methods, while allowing developers to use the language of their choice for implementing these methods. (The current release of SOM supports the C language.) Most programmers will be able to use SOM quickly, without having to learn a new language syntax.

84 OS/2 HAS BECOME A PREFERRED PLATFORM FOR DEVELOPERS

Developers like writing applications under OS/2. Its innate advantages give them room to create software that goes beyond the monotasking, memory-limited programs that have become commonplace in the PC market. Instead of attempting to shoehorn capabilities into a tiny box, OS/2 gives developers a wider playing field to follow their imagination with fewer restrictions.

The OS/2 development process is not only more powerful, it is simpler. Programming commands are executed in a more direct, explicit way. In the long run, the streamlined development process results in more efficient programs, happier programmers and delighted end users.

85 OS/2 TOOLS ARE A COMPLETE 32-BIT DESIGN SET

IBM provides a robust set of tools to speed the development of OS/2 32-bit applications. There are four core development tools: The IBM C Set/2 C compiler, the OS/2 Developer's Toolkit, the WorkFrame/2 development environment, and the OS/2 Technical Library. Qualified developers can also receive the OS/2 Professional Developer's Kit. These tools combine to provide professional developers with a complete solution for designing and implementing sophisticated 32-bit OS/2 applications.

86 WINDOWS APPLICATIONS ARE EASILY TRANSLATED INTO OS/2

With Micrografx Mirrors* Windows applications can be quickly and readily ported to OS/2. Mirrors gives software vendors more opportunities to market their products, and it gives corporate developers a better way to meet user needs or for large corporations to develop in-house applications that don't require massive retraining.

A ported application, while still 16-bit, has performance advantages. OS/2 manages memory more intelligently than Windows, resulting in better performance. In addition the OS/2

32-bit graphics engine provides much higher performance than the older 16-bit engine. The result is the best of both worlds. Mirrors makes every effort to retain identical operation between the original and ported versions, without sacrificing the OS/2 look and feel.

87 IBM SUPPORTS OS/2 DEVELOPERS

The IBM Worldwide Developer Assistance Program (DAP) supports any developer, anywhere, in the development of OS/2 applications. Commercial software developers can extend their membership in DAP with the Commercial Services program. This program includes additional online technical support, complimentary subscriptions to *OS/2 Developer* magazine, and discounts on IBM products, along with marketing assistance for commercial products. Vendors whose applications exploit the 32-bit capabilities of OS/2 receive all these services, plus a personal advocate within IBM who provides assistance and support and direct E-Mail access to the IBM Boca Raton Programming Center.

IBM provides corporate developers with OS/2 development assistance through the IBM Technical Coordinator Program. This program supports corporate technical coordinators through the IBMLink electronic support library. The program also includes a monthly newsletter, the *Personal Systems Technical Solutions* magazine, satellite television updates, and conferences on technical support.

For more information on the IBM Worldwide Developer Assistance Program, call (407) 982-6408 or FAX (407) 443-4233. In Canada, call (416) 946-3786. For information on the IBM Technical Coordinator Program, call (800) 547-1283. To enroll in the OS/2 Developer Assistance Program, type GO OS2DAP at the CompuServe command prompt.

OS/2 HAS A GREAT FUTURE

88 WHAT'S NEXT FOR OS/2?

Since its release last spring, OS/2 has gained accolades from all walks of the computer industry. Also since that time, IBM has worked to further refine the system. It is bringing the most talented systems designers and developers in the world to Boca Raton to join the development team, to develop future versions.

This year, OS/2 will be pre-installed on a growing number of hardware systems from many PC vendors worldwide. Furthermore, as the operating system evolves, it will become available on several different computer architectures, including RISC and new Intel processors. And popular features of OS/2, like the Workplace Shell, will begin appearing in a wide variety of systems and devices, such as DOS and AIX. IBM is fully committed to exploiting emerging hardware and software technologies that customers want.

89 OS/2 WILL MAKE A GOOD SYSTEM EVEN BETTER

Future versions of OS/2 will include a number of improvements targeted at improving performance and fully exploiting OS/2's 32-bit architecture, the two major requests from the growing installed base of users.

These upgrades will include features like a completely new graphics engine with superior screen display and more flexibility for OS/2 developers. OS/2 will expand support for Windows. It will also include multimedia extensions (previously available separately) to integrate sound, video and text.

90 OS/2 WILL ENHANCE WINDOWS FUNCTION

Support for Windows 3.1 environment under OS/2 will give you much more than just Windows. By running Windows 3.1 applications under OS/2, you will get all of the benefits of the DOS graphical user interface within the framework of a true 32-bit operating system. OS/2's WIN-OS/2 component will run Windows 3.x programs in real and standard mode.

OS/2 will also take best advantage of Windows' under-the-hood features. These include the ability to link "live" copies of files and data between programs with Object Linking and Embedding (OLE) and Dynamic Data Exchange (DDE). Also, OS/2 will include Windows multimedia extensions, as well as a set of the Windows 3.1 "applets," including the Calculator, Cardfile and File Manager.

91 THE GRAPHICS ENGINE WILL BRING STUNNING VISUAL POWER TO OS/2

The OS/2 graphics engine—which translates OS/2 commands into what you see on the screen—will make it possible to create and display stunning images. A full 32-bit implementation of the graphics programming interface, it nonetheless will be fully compatible with 16-bit device drivers. Your existing display drivers will work as well as they do today.

The graphics engine will support higher graphical resolution than was possible under OS/2 previously, while being compatible with your current hardware. The developer will gain more control and more options with the graphics engine since it enables the use of the Palette Manager, which finetunes color schemes. For the user it will offer better looking screens, and maintain color when you click from one window to another. Users will also notice that graphics will generally paint faster with the addition of the 32-bit graphics engine.

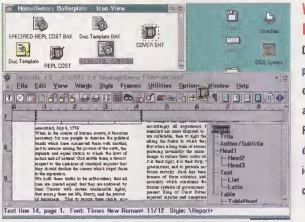
92 OS/2 WILL BECOME SMALLER

And what do customers want? Consistently, they have told IBM that a good operating system must take up as little space as possible, both in RAM and on the hard disk. At the same time, power cannot be compromised.

IBM has begun work already to shrink OS/2's system memory requirements. Today, OS/2 can run two substantial applications simultaneously in 6 MBs of RAM. IBM's goal is to match this performance in a 4 MB system, to enable users to run OS/2 on smaller, less powerful machines, or free up memory on larger machines.

In addition to shrinking the amount of RAM required by OS/2, future versions will help to further minimize the

amount of hard disk space required by the system. Today's OS/2 already allows you to select or omit applets at installation, to use only the features that meet your needs. As you buy more powerful programs to replace OS/2's included applets, it will be easy to reclaim hard disk space. IBM is also looking at new compression techniques that will reduce the system's hard drive storage requirements even more. With these new features, there will be additional space on the hard drive for exciting new 32-bit applications.



WORD PROCESSING DELUXE

DeScribe 4.0, a full 32- bit application, takes full advantage of the Workplace Shell's drag-and-drop functions. Here, a FAX cover sheet object is dragged to DeScribe's insert icon, automatically placing its contents at the cursor point.

93 OS/2 WILL BECOME FASTER

In addition to the shrinking of operating system memory requirements, users can expect increased speed and performance in both the operating system and the applications. The result will be faster program loading and faster performance, especially for applications that exploit features such as pre-emptive multitasking, 32-bit flat memory model, and the High Performance File System (HPFS)—all features which hold great benefits for the business user.

As computer hardware pushes the speed envelope, OS/2 will continue to expand device-driver support to take advantage of these new technologies. By replacing 16-bit device instruction sets with the 32-bit graphics engine, OS/2 will fully exploit accelerator cards and other performance-related hardware technologies. In addition, OS/2 will continue to support new hardware technologies as they emerge in the marketplace. So as new machines emerge, users won't need to relearn basic commands.

94 OS/2 WILL BECOME MORE PLEASURABLE TO USE

A smaller and faster operating system will be more enjoyable to use in the broadest range of environments, and will be the ideal foundation for new "applets." For example, a FAX application with a Presentation Manager interface and drag-and-drop capability is planned. IBM is also exploring more intuitive input methods, like speech, pen and touch.

IBM will also be extending OS/2's object orientation to make the system even easier to master. The drag-and-drop capability in the Workplace Shell, for instance, could evolve so that you might drag the title bar of a folder onto a printer icon and automatically print every file in that folder. This saves time and lessens the number of commands to execute a function.

95 OS/2 WILL CROSS PLATFORMS

IBM Personal Software Products will continue meeting customers' needs by extending the OS/2 operating system to new computer architectures, including RISC-based systems like the PowerPC, new Intel-based platforms, and other emerging platforms. The company intends to make OS/2 portable and to add support for multiprocessor computers.

When OS/2 is made portable, you will be able to run DOS, Windows and OS/2 applications across Intel and non-Intel architectures, thereby closing the gap between the applications you want to run and the hardware you own. In addition to developing a portable OS/2, IBM intends to make the Workplace Shell a common user interface across multiple platforms. For example, the Workplace Shell will be available on the AIX/PC operating system, as well as DOS. OS/ 2 will also be enhanced to support pen-based computers.

96 OS/2 APPLICATIONS ARE FLOODING THE MARKET

By the end of 1992, there were over 1,000 native OS/2 applications available. Many of these take full advantage of OS/2's 32-bit memory model and its robust implementation of pre-emptive multitasking. All of them have the potential to enhance your computing environment.

OS/2 applications span the full range of user requirements, from astonishing 32-bit games to powerful word processors like DeScribe to products that introduce a new model for client-server computing like IBM Database Manager for OS/2. And OS/2 will run your DOS and Windows applications transparently, combining the new generation of powerful 32-bit applications with your current software.

97 OS/2 WILL BRING MULTIMEDIA AND NETWORKING INTO THE FOREFRONT

Soon, OS/2 will make it even easier for people to tap into the power of multimedia and networking. Upcoming versions of OS/2 will incorporate multimedia extensions into the base operating system, with no rewiring required. This means that users will be able to interact with the computer in a more natural way, using speech and audio to direct the activities of the OS/2 Workplace Shell. Users will also be able to play movies on-screen from either remote or local video files at rates in excess of 15 frames per second, fast enough to eliminate the jerkiness associated with motion video on computers today.

IBM also intends to make OS/2 "LAN ready," so that when it's installed as a network client, the client

MAJOR DISCOVERY

OS/2 Multimedia can help you to rediscover history. Here, with IBM's "Columbus" application, OS/2 displays images, sound and text in ways that other systems do not permit; to take you back in time.



computer will automatically recognize the network. To do this, IBM expects to use some functions available in OS/2 Extended Services today, along with new capabilities in development. A "LAN ready" version of OS/2 would recognize Novell NetWare® and other network operating systems, as well as IBM LAN Server networks. Installation and configuration of local area networks will be much easier for users and administrators.

98 OS/2 IS THE BEST PLATFORM TO EXPLOIT MULTIMEDIA

Multimedia computing has received a great deal of attention in the last year, as vendors introduce new and sometimes conflicting standards. OS/2 is unique among multimedia products in its ability to support robust multimedia applications without any loss in content quality or performance.

Because OS/2 can run multiple processes simultaneously, OS/2 multimedia applications can simultaneously pull video threads and audio threads, from remote (networked) sources or the local hard drive, without causing any of the jerkiness or freezing associated with other operating system platforms. With the right hardware, users can even view several video clips simultaneously, scale the size of windows containing video, and modify playback speed without degrading system performance.

OS/2 now has digital sound capability which was previously available as a separate product. Full motion video support will be available later this year, completing the OS/2 multimedia equation.

Special thanks to One-Up Corporation, (800) 678-0157, for compiling screen shots for this supplement.

99 IBM WANTS YOU TO STAY IN TOUCH

IBM wants OS/2 to fulfill your expectations of a superior operating system, and it can only do that if you give the company your input about OS/2. What do you like about the system? How could it be improved? Is there something missing that you need for your specific task? Is there something about OS/2 that could be simplified? Can we improve the interface? If you haven't worked with OS/2, what has prevented you from giving it a chance? IBM will use this information for the development of future versions of OS/2.

There are many ways to communicate with IBM. Perhaps the easiest way is through the OS/2 forums on CompuServe and other BBSs. Here, users can make comments or ask questions about OS/2 and receive a direct response from the IBM OS/2 support staff.

You can log on to the IBM CompuServe forum by typing GO IBMOS2. If you're thinking about purchasing OS/2 and have questions, give IBM a call at (800) 3IBM-OS2 (342-6672). In Canada, call (800) 465-7999. If you've already purchased OS/2 and have a question, call the IBM toll-free support number that came in your package.

100 FOR MORE INFORMATION...

If this supplement has whetted your appetite for information about OS/2, it's easy to find out more.

Since most OS/2 sales occur in computer stores, a retail sales representative can answer your questions and give you a demonstration of OS/2. For the name of a dealer near you, call the IBM Business Partner Locator at (800) 426-9292.

If you can't get to a computer store, additional information about OS/2 is available from the IBM Order Center. This group takes your order for a copy of OS/2. To reach the IBM Order Center, call (800) 3IBM-OS2 (342-6672).

For IBM technical manuals on OS/2 and other IBM products, call PC Books, the distributor of IBM publications, at (800) 426-7282.

To access the OS/2 forums on CompuServe, type GO IBMOS2. Subscriptions to *OS/2 Developer* magazine are $39.95 for four issues or $9.95 per issue. To subscribe, call (800) WANT-OS2 (926-8672) or FAX (708) 647-0537.

To purchase the $25 OS/2 Service Pack, call (800) 3IBM-OS2.

For more information or to enroll in the IBM Worldwide Developer Assistance Program, call (407) 982-6408 or FAX (407) 443-4233.

In Canada, call (416) 946-3786. You can also enroll through CompuServe by typing GO OS2DAP. To learn more about the Technical Coordinator Program, call (800) 547-1283.

IBM offers a wide range of courses on OS/2 and other IBM products. These range from technical courses for professional programmers to seminars for end users. To find out more, call (800) IBM-TEACH (426-8322).

If you still can't get the information you need or have a question that doesn't fall into any of these categories, contact the IBM General Information Center: (800) 426-3333. In Canada, call (800) 465-7999.

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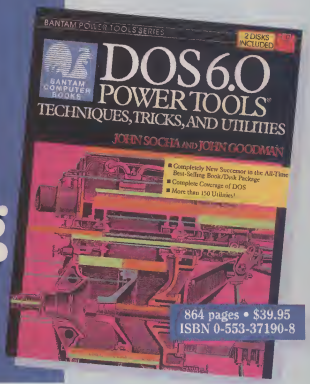
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VALJEAN CLARK
CARSON CITY, NEVADA

QUATTRO PRO

FILL YOUR CELLS WITH BULLETS

Use bullets to emphasize important information. Place the cursor in a cell you want to highlight, then press Ctrl-D. Release both keys, and press Ctrl-G to embed a bullet into the cell. For additional styles, press Ctrl-D, Ctrl-I (hollow bullet); Ctrl-D, Ctrl-O (bold asterisk); or Ctrl-D, Ctrl-P (bold arrow). Follow Ctrl-D with Ctrl and any letter except D to create other bullets.

Note: Some characters can't be seen on some monitors with Quattro Pro in Wysiwyg mode. If you see a question mark (?) in place of a character, select Options, Display, and choose 80x25 to view the characters onscreen.

SHANE DEVENSHIRE
WALNUT CREEK, CALIFORNIA

WORD FOR WINDOWS

PRINT MULTIPLE FILES

If you're printing several documents, don't do them one at a time—make Word print them all at once. Choose File, Find File. Click on Search, then click on Edit Path to specify the directories containing the files you want to print. To add a directory to the search path, select it and click on Add. To remove a directory, select it in the Search Path: box and click on Delete.

After selecting directories, click on Close. The File Name and File Type boxes should correspond to the files you'll be printing. Click on Start Search. Hold down Ctrl and click the mouse to select nonadjacent files, or hold down Shift and click to select adjacent files from the File Name window. Click on Print to send them all to the printer.

SHANE DEVENSHIRE
WALNUT CREEK, CALIFORNIA

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AUTHORITATIVE ANSWERS TO YOUR MOST PRESSING PC QUESTIONS. BY DALE LEWALLEN AND JEFF PROSISE

Advanced Power Management

I'm interested in running DOS 6.0's new POWER.EXE device driver on my laptop to lengthen battery life, but I'm not sure whether my laptop supports the advanced power management (APM) specification. According to the DOS manual, running POWER.EXE on an APM-compliant laptop can boost a battery charge by 25 percent, compared with only 5 percent for non-APM laptops.

Is there an easy way to determine whether a laptop has APM support built in?

RICHARD DANIELS
BIRMINGHAM, ALABAMA

Yes, there is—with a utility called APM.COM that you can create with DEBUG. Just enter the following commands in a text file named APM.SCR:

```
N APM.COM
E 0100 EB 26 41 50 4D 20 69 73
E 0108 20 73 75 70 70 6F 72 74
E 0110 65 64 24 41 50 4D 20 69
E 0118 73 20 6E 6F 74 20 73 75
E 0120 70 70 6F 72 74 65 64 24
E 0128 B8 00 53 33 DB CD 15 72
E 0130 11 81 FB 4D 50 75 0B B4
E 0138 09 BA 02 01 CD 21 32 C0
E 0140 EB 09 B4 09 BA 13 01 CD
E 0148 21 B0 01 B4 4C CD 21
RCX
4F
W
Q
```

Run the script file through DEBUG by typing DEBUG < APM.SCR at the DOS prompt. To run the utility, enter APM. If your BIOS supports advanced power management, this utility reports, "APM is supported" and returns an exit code of 0. Otherwise, APM reports, "APM is not supported" and returns an exit code of 1. The exit codes are helpful in batch files with IF ERRORLEVEL commands.

You can download APM.COM (both the executable program and the DEBUG script) from PC/Contact, *PC/Computing*'s online forum under the name APMCHK.ZIP in data library 1 (Hot Tips/Secrets). If you don't have a CompuServe account but would like this program, see page 322.

Lost DOS Commands

I was disappointed to read that ASSIGN and other commands aren't available in DOS 6.0. For example, I have an old game program on a copy-protected 5¼-inch disk that insists on running from drive A:. Because my A: drive is a 3½-inch model, I use the command ASSIGN A=B to run the program. How will I run this program under DOS 6.0?

ART CONNORS
CHICAGO, ILLINOIS

ASSIGN was dropped from DOS 6.0, but SUBST remains. You can fool a program that's running from drive B: into thinking that it's running from drive A: with this command:

```
SUBST A: B:\
```

To restore normal operation, type

```
SUBST A: /D
```

ASSIGN is one of several commands that were dropped from DOS 6.0.

Help About...

CACHES

I JUST REPLACED MY 386 WITH A NEW 486 SYSTEM THAT BOASTS A 256K CACHE. I ALSO OWN QEMM-386, WINDOWS 3.1, AND THE NORTON UTILITIES—ALL OF WHICH HAVE THEIR OWN CACHES.

DO ALL THESE CACHES HELP MY SYSTEM'S PERFORMANCE, OR CAN I DO WITHOUT SOME?

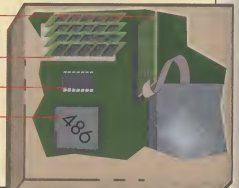
ANN BURNETT
MONTREAL, CANADA

All coches ore helpful—unless they toke up RAM thot your softwore needs. The coche inside your CPU (usually 8K) and the externol CPU coche (in your cose, 256K), which is colled o secondory or RAM coche, don't toke up ony RAM. Their job is to buffer the doto going between the fost CPU and the slower RAM memory. If your hord disk or controller olso hos o disk coche, it's implemented in hordwore os well ond doesn't toke up RAM.

Softwore disk coches, on the other hond, do use system RAM. Most require o chunk of memory, which then becomes unovoilable for opplicotions. The coche's buffer speeds up doto occess ond transfer, but if your softwore needs more RAM in order to function foster, you moy not goin overoll speed. The best compromise for o system running Windows with 4MB of RAM or more is o disk coche of 512K to 1MB.

One woy to ovoid o compromise is to use the disk coche from the $129.95 PC-Kwik Power Pok. By defoult, this coche grobs oll ovoilable memory (colled the pool) when it loods, then lends out portions of thot memory to other opplicotions (including Windows) os needed. PC-Kwik olso includes o print spooler ond o RAM disk utility thot con use memory from the pool and then return it when you're finished printing or no longer need the spoce in the RAM disk.

For more informotion obout the PC-Kwik Power Pok, contoct PC-Kwik Corp. ot 15100 S.W. Koll Pkwy., Suite I, Beoverton, OR 97006; (800) 274-5945, (503) 644-5644, (503) 646-8267 fox.



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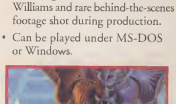
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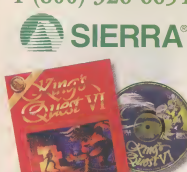
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The others include RECOVER, MIRROR, and BACKUP. If you miss them, order the MS-DOS Supplemental Disk, for which there is a coupon in your DOS 6.0 manual. The cost of the disk was not finalized at press time, but Microsoft indicated that it would probably be $10 or less.

Besides some orphaned commands, the Supplemental Disk contains Access DOS, a set of programs for handicapped users. One of the Access DOS programs, for example, makes the Shift, Alt, and Ctrl keys "sticky," enabling key combinations such as Shift-A and Ctrl-Alt-Del to be entered one keystroke at a time.

Backups for Several PCs

My department has four 386 PCs and one XT, all of which have hard disks that store separate data. We would like to be able to back up all the hard disks on tape. To share a tape drive among PCs, must we install an interface card in every PC, or connect the drive to a floppy drive controller?

JOSE PEREZ-PADILLA
MEXICO CITY, MEXICO

Challenge

PC Contact

I'M ABOUT TO START A LARGE PROJECT IN WHICH I HAVE TO SHARE DATA WITH COLLEAGUES, MANY OF WHOM HAVE MACINTOSHES. I KNOW THAT THERE ARE PRODUCTS THAT CAN TRANSFER DATA BETWEEN PCS AND MACS, BUT I'VE NO IDEA HOW TO KEEP THIS PROCESS SIMPLE. CAN WE ALL USE ONE APPLICATION, OR DO WE HAVE TO SEND ASCII DATA BACK AND FORTH?

HAROLD CHEN
OKLAHOMA CITY, OKLAHOMA

There ore o number of woys to tronsfer doto between computers thot use different operoting systems ond opplicotions. This month's Chollenge is to come up with os mony woys os possible to tronsfer doto between Mocs ond PCs. Answers con include hardwore, softwore, ond other methods. If you feel up to the Chollenge, drop us o letter morked "June Chollenge." If we publish your solution, we'll send you o *PC/Computing* "I Solved the Chollenge" T-shirt, so include your shirt size: S, M, L, or XL.

FEBRUARY CHALLENGE SOLVED

Mony situotions coll for multiple users to shore o single compuier system. The Februory Chollenge came from o reader who wos hoving trouble keeping files secure on o shored PC. We osked you to come up with suggestions. We were looking for woys to organize files, ways to moke files difficult to find and open, ond other methods thot you hove developed for keeping files privote an o shored PC.

Severol reoders suggested the ATTRIB commond, which hides and unhides files. But it's o pretty well-known trick, ond onyone con find the hidden files if they know how to use it. Severol reoders suggested creoting a directory by using the null character (hold down the Alt key, ond press 255 on the numeric keypod). This still leoves o <DIR> entry, olthough it doesn't hove o nome.

The simplest woy to secure your files is to moke them unusoble to onyone but yourself. The winner of the Februory Chollenge is Ben Jocobsen of Fort Worth, Texos, who suggested using the possword-encryption feoture of the sharewore program PKzip. This keep the contents of your files secret *ond* reduces their size—o double benefit. Unfortunately, the syntax is o little tricky to moster—try this on for size:

PKZIP–*spassword zipfile filename*

In foct, you could creote o botch file to wrop oround PKzip to moke it even eosier for users to encrypt or unencrypt their files. Version 2.04—which offers foster ond better compression—is ovoilable from PKwore, Public Brond Softwore, ond PC/Contoct os PK204G.EXE in doto library 3 (Utilities/Misc.). To order o registered copy ($47 plus $5 shipping), contact PKwore, 9025 N. Deerwood Dr., Brown Deer, WI 53223-2437 or coll 414-354-8699. Becouse PKzip is o shoreware progrom, you'll need to poy the registrotion fee to the progrom's outhor if you wont to keep using it after the evoluotion period.

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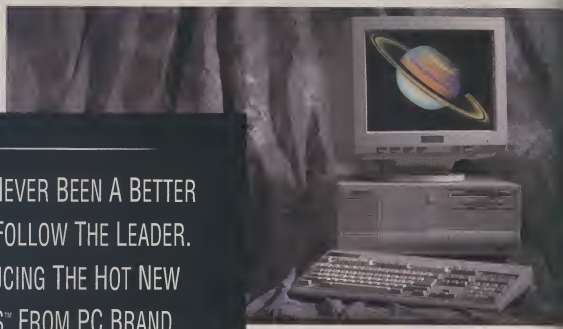


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How to Get a Gigabyte

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There's already a multitude of ways to get a gigabyte of storage. The trick is to get the most for your dollar. Expert Winn Rosch explains the options, including hard drives, optical cartridge drives, magneto-optical drives, and tape backup drives.

Plus . . . optimizing DOS 6.0's DOUBLSPACE, speeding up Windows with efficient font management, how disk optimizers work, networking smarter, and reviews of hot new software and hardware.

Q&A

The classic solution is to tie the PCs together with a small LAN. Attach the tape drive to the PC designated as the file server, and you can access it from all the PCs or you can assign each user space on that server's hard disk, and then back up that server's hard disk. However, keep in mind that networks aren't cheap (the minimum cost is about $200 per PC, plus the expense of a dedicated file server and the labor involved in installing network cards, cable, and so on), so this may not be the best solution.

Instead, you can purchase a tape drive that uses a parallel port rather than a dedicated controller card. Simply unplug the drive from the back of one PC and plug it into another. A 1992 MVP finalist, Colorado Memory Systems' Jumbo Trakker 250, fills the bill at $548. Micro Solutions of DeKalb, Illinois, sells a similar unit called the Backpack Tape Drive for $539. Both drives' performances are on a par with those of tape drives with proprietary interface cards. For more information about the Jumbo Trakker 250, contact Colorado Memory Systems at (800) 845-7905. To learn more about the Backpack Tape Drive, contact Micro Solutions at (815) 756-3411.

Do you need help using your computer? Q&A provides practical advice on PC problems. Questions are selected on the basis of broadest interest and may be edited for clarity and length. Sorry, but we cannot answer questions individually. Send your question, along with any screen printouts or other details that could help solve it, to Q&A, Help, *PC/Computing*, 950 Tower Lane, 20th Floor, Foster City, CA 94404. You can also reach us via CompuServe, on *PC/Computing*'s PC/Contact online service. Send your comments or questions to 76000,21.

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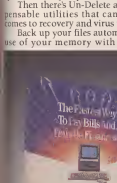
It's the latest version (packed with new features and enhancements!) of the operating system that changed the world. First there's DoubleSpace, a sleek compression utility that gives you more storage space–instantly! Up to DOUBLE the disk space!

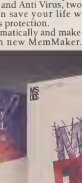
Then there's Un-Delete and Anti Virus, two indispensable utilities that can save your life when it comes to recovery and virus protection.

Back up your files automatically and make better use of your memory with new MemMaker. Plus, there's an advanced defragmentation utility that keeps your system running smooth and lean–it's based on the famed Norton Speed Disk.

There's more! Like new communications capabilities so you can access files, peripherals and e-mail over networks. Plus, an all-new set of DOS commands (typing MOVE, for example, moves a file!). Of course, there's enhanced On-Line Help, to show you the ropes in any situation. And the system startup has been streamlined and greatly simplified; the new *Clean Boot* feature actually bypasses the AUTOEXEC.BAT and CONFIG.SYS.

And to round out DOS 6, there are a few goodies for laptop and notebook PC users: One program connects two PCs for fast, easy file transfer, another conserves battery life on APM (Advanced Power Management) compliant machines. DOS 6 is perfect for laptop and notebook users who used to have to load all these utilities individually. In all, there are a wealth of new treasures for DOS users, making it simpler and faster to get things done. Novice users will be up and running in minutes with DOS 6's simpler approach.





DOS 6: WHAT'S NEW?

- DoubleSpace: Up to double the storage capacity with on-the-fly compression. Just type DBLSPACE
- MemMaker: Frees up and maximizes memory; writes AUTOEXEC.BAT and CONFIG.SYS for you
- Anti-Virus: Protect your data from the threat of computer viruses–automatically!
- New StartUp Options: includes the fast new "Clean Boot" feature
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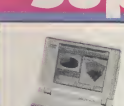
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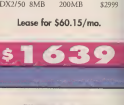
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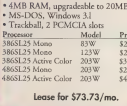
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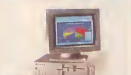
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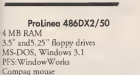
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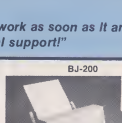
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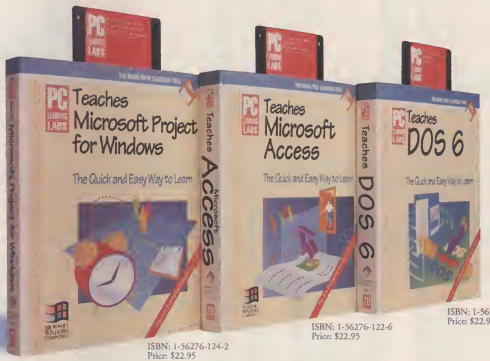
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M ☐ Add-in Board
N ☐ Modem
O ☐ Input Device
P ☐ Local Area Network

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S ☐ Personal Finance
T ☐ Desktop Publishing
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W ☐ Graphics
X ☐ Utility
Y ☐ Communications
Z ☐ Windows/Multi-tasking
1 ☐ Programming Language/Compiler
2 ☐ Integrated/Multifunction
3 ☐ CAD

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Please answer questions below:

1. **Where do you use your computer?** (Check one only):
   A. ☐ Home B. ☐ Business C. ☐ Both

2. **What kinds of computers do you use?** (Check all that apply):
   D. ☐ IBM/Compatible Laptop E. ☐ IBM/Compatible Desktop F. ☐ MAC

3. **Do you plan to buy any of the hardware or software mentioned below in the next three months?** (Check all that apply):

HARDWARE	SOFTWARE
G. ☐ PC	Q. ☐ Accounting
H. ☐ MAC	R. ☐ Spreadsheet
I. ☐ Laptop	S. ☐ Personal Finance
J. ☐ Printer	T. ☐ Desktop Publishing
K. ☐ Monitor	U. ☐ Word Processor
L. ☐ Disk/Tape Back-up	V. ☐ Database Manager
M. ☐ Add-in Board	W. ☐ Graphics
N. ☐ Modem	X. ☐ Utility
O. ☐ Input Device	
P. ☐ Local Area Network	

	Y. ☐ Communications
	Z. ☐ Windows/Multi-tasking
	1. ☐ Programming Language/ Compiler
	2. ☐ Integrated/Multifunction
	3. ☐ CAD

4. **From which of the following sources do you purchase personal computer products?** (Check all that apply):
   4. ☐ Specialty Computer Retail Stores 6. ☐ Direct from Manufacturers
   5. ☐ Mail Order Firms 7. ☐ Other

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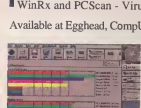
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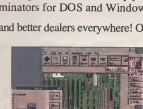
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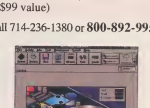
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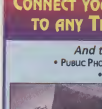


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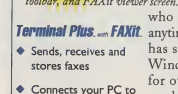


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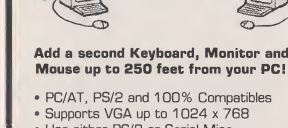
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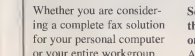
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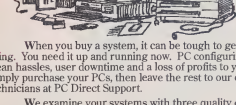


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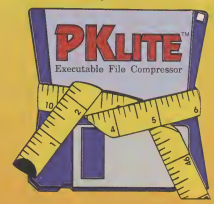
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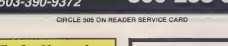
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Market Study, Base: employed subscribers

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Source: 1st Half 1992 Buying Trends Market Study
Base: employed subscribers

Penn Jillette

I Want More Bias—And Less News

There's more to replacing the newspaper than a CRT that'll fit on the bottom of a bird cage.

I LOG ON to CompuServe every day. I write to friends on it and use it for faxes and snail mail. The only drag is that I can't receive faxes on my CompuServe account. [*Note to geniuses:* Why don't you quit whatever you're doing and work on better optical character recognition so I can receive faxes without having to download graphics? I want to scan and then be able to manipulate (plagiarize) the text. If you're working on an itty-bitty-feather-light-8-hour laptop battery, soundproofing so I can play music later and louder without neighbors pounding on my door, or a vaccine for any disease that strikes my personal high-risk group, stick to your mission. Otherwise, you geniuses should dedicate your lives to better OCR.]

When I first got on CompuServe in 1985, I browsed around. I'd stop into the CB simulator (great name, huh? Technology jumping on that C. W. McCall "Convoy"). I like sex talk on the CB simulator. It's a good place for a human being with genitals like mine to experience typing as a 5-foot 10-inch, 19-year-old, fun-loving, lonely red-headed woman named Uma who loves nerds. (It's too bad they don't have Academy Award nominations for best e-mail female impersonator; then there would have been some competition.)

I tried getting my news from CompuServe. It seemed perfect for me—up-to-the-second pure news with word searches. *Uma Thurman* was the first string I had it check. Then I had it search for *Penn* and *Teller* within ten words of each other and I was really cool until a bank in Pennsylvania was robbed and I was flooded with false hits. But CompuServe didn't replace the newspaper for me, because it has too much information and not enough bias.

I read the *New York Times.* I don't agree with it much (except for Frank Rich's praise for our show). During last year's campaign, the *Times* kissed Clinton and I didn't. My politics are different. [*Hint:* The man and woman team I voted for were on the ballot in all 50 states, weren't in any of the TV debates, and you could store the full names of all the people that voted for them, uncompressed, on six floppies with room left over for WordStar (not 2000). Of course, now that Bill's my President, I'm behind him 103 percent because that's the kind of American I am, goddamn it.]

I fancy that I can factor in the *Times'* slant, but it would be better if news didn't even pretend to be objective. I'd like the meat puppet on the nightly news to say, "Today Perot, the big-eared psychotic, unveiled *his* so-called economic plan." Perot supporters would then know who was selecting the sound bites. A concealed bias will make you crazy; an overt bias is just more fun.

I read the *Times* because others read the *Times.* If you're having a delightful screaming match over current events, you want to start with the same information. That makes it a fair fight. With the same information, you don't just learn about your discussion partner's sources, you learn about his or her heart and soul, and that's why we're alive.

To replace the newspaper, we have to make a CRT that can fold up on the subway, and there are people who'll make one do just that. The hard part is taking the gigabytes of information available every hour, throwing most of that away, and slanting the rest. People need to know when they've finished reading, and the info needs a solid slant. That way you'll have a good reason to throw your electronic newspaper across the damn room. ◩

ILLUSTRATION BY CAT BARTHOLOMEW



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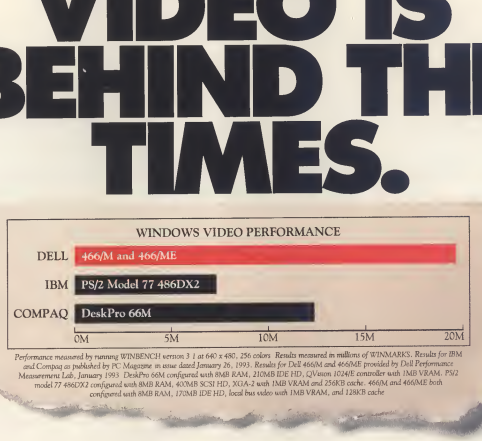
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Performance measured by running WINBENCH version 3.1 at 640 x 480, 256 colors. Results measured in millions of WINMARKS. Results for IBM and Compaq as published by PC Magazine in issue dated January 26, 1993. Results for Dell 466/M and 466/ME provided by Dell Performance Measurement Lab, January 1993. DeskPro 66M configured with 8MB RAM, 210MB IDE HD, QVision 1024/E controller with 1MB VRAM. PS/2 model 77 486DX2 configured with 8MB RAM, 400MB SCSI HD, XGA-2 with 1MB VRAM and 256KB cache. 466/M and 466/ME both configured with 8MB RAM, 170MB IDE HD, local bus video with 1MB VRAM, and 128KB cache

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